

# **A Comprehensive Framework with Design Principles for Supporting Interaction in Fully Online Courses**

**A thesis submitted for the degree of  
Doctor of Philosophy**

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## **Declaration**

I declare and certify that:

- a) except where due acknowledgement has been made, the work is that of the author alone;
- b) the work has not been submitted previously, in whole or in part, to qualify for any other academic award;
- c) the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program;
- d) any editorial work, paid or unpaid, carried out by a third party is acknowledged;
- e) ethics procedures and guidelines have been followed.

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*“Technological disruption through the potential of online education has once more become a matter of discussion and strategic evaluation. Technological disruption is seen as a source of increased competition. How well we are using the possibilities in our many ‘smart’ learning and teaching spaces for better student learning experience and outcomes remains a challenge.”*

*(Email sent to all RMIT staff titled “Stormy Weather” on August 9, 2012)*

- Professor Margaret Gardner AO  
Vice-Chancellor and President  
RMIT University, Melbourne, Victoria  
Australia

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All stages were reviewed and approved by the RMIT University Science, Engineering and Health Human Research Ethics Committee and all trademarks are the owners of the respective companies and organisation.

## Credits

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# Abstract

Advances in computer-mediated communication technologies have sparked and continue to facilitate the proliferation of online courses and degree programs in educational institutions. Fully online courses are becoming progressively more popular because of their “anytime anywhere” learning flexibility. These fully online courses are conducted via Internet-based learning environments and there are no face-to-face classes. One important aspect of any online learning environment is interaction. Different types of interactive activities assist students to share and gain knowledge from each other. However, quality interaction in fully online courses does not always take place and there is a lack of clarity about the appropriate role of the instructors in them.

This thesis examines different types of interaction in fully online computing courses and develops frameworks with design principles for supporting quality interaction. By investigating different types of interaction and how quality interaction can be defined, we identify the best practices for fully online course management and provide significant guidelines for improvement of teaching and learning in fully online computing courses.

In the first stage of the research, we investigate the course management factors that impact student participation and achievement in fully online computing courses. We identify several factors that affect student participation and grades. These results provide valuable information about expected student behaviour in fully online computing courses and hence support and add additional knowledge to prior research regarding interaction, undertaken in on-campus and blended learning environments.

In the second stage, we identify two sets of criteria and two frameworks for effective interaction between students and instructors. These frameworks provide

guidelines on how quality interaction can be designed and assessed. In the third stage, we evaluate the two frameworks developed in the previous stage.

In the fourth stage of the research, we investigate student – content interaction and identify several factors that impact interaction between students and content. Identification of these factors provides guidelines in setting up and managing effective interaction between students and content.

# Chapter 1 - Introduction

## ***1.1 Overview***

Encouraging interaction in online courses in tertiary education has long been an interesting research topic. The introduction of fully online tertiary courses, such as those offered by Open Universities Australia (<http://www.open.edu.au>) or the Open University (<http://www.open.ac.uk>), means that interaction between teachers and learners must be carried out via online environments. Online learning facilities can enable students to have control of their own studies in terms of time and space and assist students to fill the gaps in their individual knowledge according to their needs. Online interactive activities can assist learners to share and gain knowledge from each other.

Online participation, measured as interaction with peers and instructors, has a positive effect on perceived learning, grades and quality assessment of assignments (Hrastinski 2008). The way online participation can be designed in fully online courses needs to be adequately investigated (Nandi, Chang & Balbo 2009). While a considerable amount of research has been undertaken to analyse the content of forum participation, there is a need for ongoing research to investigate how quality can be evaluated and how productive student participation can be increased (Blignaut & Trollip 2003). In particular, most of the research in this area has been conducted in blended learning environments, in which there is a mixture of traditional face-to-face classes and online activities. Although many of the same underlying principles of teaching and learning still apply, fully online courses are qualitatively different from traditional, classroom-based courses (Dennen 2005). Online education is faced with an interesting paradox of growing demand and enrolment coupled with higher withdrawal and

failure rates (Capra 2011). Our research will enable us to identify which strategies should be followed to improve participation, engagement and hence overall results in online computing courses.

Our work deals with courses offered in a fully online environment, in which there are no face-to-face classes. The objective of this research is to increase the understanding of the quality of interaction and develop frameworks to support interaction in fully online computing courses.

## **1.2 Research Questions**

Increasing our understanding of the dimensions of interaction in fully online courses and developing a framework with design principles to support interaction will provide valuable guidelines for educators and institutions conducting these courses. In addition this knowledge will increase our understanding of quality interaction and how it affects student participation and achievement. In line with this, the main research question of this thesis is:

*How can we develop design principles for quality online interaction in fully online computing courses?*

The specific questions are:

- 1. What are the important factors that affect student activity in fully online courses?*
- 2. How can we evaluate quality interaction between students in fully online courses?*
- 3. How can we define the appropriate criteria for the instructor to interact with the students in fully online courses?*



*4. What factors need to be considered for designing effective student – content interaction in fully online courses?*

Identifying the factors affecting student activity will provide us with an understanding of the impact, different course management factors have on the students. Through the second and third specific questions, we will investigate the criteria for quality interaction among students and define roles of the instructor. Finally, through the fourth specific question, we will explore and identify the factors affecting effective student – content interaction. Answering the four specific questions will provide us with a set of design principles or guidelines to develop frameworks to support interaction in fully online computing courses. Frameworks are guiding principles of research and practice within a particular discipline. Through this research we develop and evaluate sets of guidelines for interaction in the form of frameworks in order to support both instructors and students within the online education environment.

### **1.3 Contributions**

Our contributions are in four areas. First, our analysis of student activities and achievements provide insights into overall student participation in fully online courses. This will enable the educators to adopt and follow the appropriate course management practices depending on the course content and the relevant student cohort.

Second, we identify and develop a framework with a set of criteria for student – student interaction in fully online computing courses. A framework such as this not only enables the evaluation of the overall effectiveness of discussions, but also makes explicit and transparent to students the expectations of their engagement in discussions, and thereby shapes that engagement.

Third, we identify the appropriate role of the instructor in facilitating discussion forums in fully online courses. Through this identification and analysis, we develop a framework which defines criteria for quality moderation. Our framework will also assist in defining and assessing roles when multiple instructors or tutors are involved in fully online courses which normally have large class sizes.

Fourth, we contribute through the analysis of the student – content interaction in fully online computing courses. We identify the strategies for effective content management techniques to ensure productive student – content interaction.

Our overall framework consisting of sets of criteria provides valuable guidelines for educators on how to set up and ensure quality interaction in fully online courses. We also provide knowledge on how this framework can be utilized for assessment purposes as well as to evaluate course management, quality of student – student interaction, instructor contribution and content management strategies.

## ***1.4 Thesis Overview***

The remainder of this thesis has 7 chapters. In Chapter 2, we provide an overview of the relevant literature including interactivity, use of discussion forums and criteria for quality interaction for effective interaction in fully online courses. We define a framework for student – student interaction and identify guidelines for student – instructor and student – content interaction.

In Chapter 3, we present our research methodology including the nature of research, the major drivers of our design approach, the environment in which the research was conducted and the various stages of our research and limitations of the research.

In Chapter 4 we provide an analysis of the factors that affect the participation and achievement of fully online students.

In Chapter 5, we develop two frameworks for student – student interaction and instructor contributions by analyzing discussion forum participation in two fully online courses.

In Chapter 6, we evaluate the two frameworks developed in Chapter 5 by conducting a survey with students and analyzing the responses. We modify the frameworks based on the findings of data analysis.

In Chapter 7, we investigate student – content interaction in which we construct a survey carefully designed to analyze this issue. We analyze the responses and develop guidelines to ensure effective student – content interaction.

In Chapter 8, we discuss the conclusions and opportunities for future research.

# Chapter 2 - The Online Context

## 2.1 Online Learning

*"We are in the process of moving:*

***From:*** *face-to-face courses using objectivist, teacher-centered pedagogy and offered by tens of thousands of local, regional, and national universities;*

***To:*** *online and hybrid courses using digital technologies to support constructivist, collaborative, student-centered pedagogy, offered by a few hundred 'mega-universities' that operate on a global scale." (Hiltz & Turoff 2005, p. 60)*

Online learning is generally defined as the use of networked information and communication technology in teaching and learning (Naidu 2006). Since the 1980s, there has been a substantial increase in the number of students studying part-time and through distance learning (Tanaka 2005). Several researchers report that there has also been a dramatic growth in non-traditional learners, beyond the typical 18 - 24 year old mainstay of university (Kim, Bonk & Zeng 2005). People are becoming more focused on web-based e-learning to improve their skills in near future (Tanaka 2005; Williams & Goldberg 2005).

Online education has increased rapidly in popularity over recent years. Every year, more universities are starting online programs (Allen & Seaman 2005; Waits, Lewis & Greene 2003). Institutional economics (such as a lack of physical classroom space, the need to attract students from beyond the immediate geographic location and economies of scale that can be achieved with more sections of a course and more students per section) and the demands of students who face a number of obstacles that make the on-campus format

inconvenient are the main reasons for this increment (Ludwig-Hardman & Dunlap 2003).

Advances in communication technologies and the growing application of a constructivist pedagogy that is learner-centred rather than teacher-centred, has changed the focus from a traditional independent learner model to one informed by social constructivism and collaborative learning principles (McDonald & Mayes 2005). The emphasis is now on learner-centeredness and peer-based activities (Oliver 2005). Collaborative activities increase the quality of overall learning and develop a culture of learning and excellence among students (Chinn & Martin 2005). Keppell et al. (2006) state that collaborative learning emphasises the sharing of knowledge and ideas between students in a reciprocal partnership.

In order to facilitate this collaboration, use of information and communication technologies and online discussions or web-based conferences has become an integral part of new models of online learning and teaching. Through networked communications, geographically dispersed students are able to participate in online discussions and group work with their instructors and peers which can reduce isolation and increase engagement (Zhang & Goel 2011). There is evidence in literature to suggest that online learning is growing rapidly as it provides students and educational institutions with great flexibility (Ellis et al. 2007; Leonard & Guha 2001). However, Dennen (2005) states that many “best practices” in fully online courses are based on intuition, personal experience and traditional instructional methods rather than on empirically based research. Online learning environments and interactivity have become the focus of ongoing research.

An online learning system has been described as a web-based learning environment consisting of digitally formatted content resources and communication devices to allow interaction (Chang & Fisher 2001; Zhu & McKnight 2001). Communication devices provide communication links between

the instructors and students where they can actively interact (Ng & Murphy 2005). Interaction between teachers and learners is now increasingly happening online (Sheard et al. 2003). Online learning increases the opportunities for learner participation and enhances the participation of learners who may feel more inhibited to engage in discussions in a traditional classroom setting (Dengler 2008).

An online learning system has been defined as an educational environment where instructors and students are separated from each other and involved in a two-way interaction using the Internet to mediate the necessary communication (Gunawardena & Mclsaac 2004) . The application of technology provides opportunities for flexible online interaction among geographically remote learners (Falloon 2011; Garrison & Anderson 2003). In the online classroom, knowledge is primarily generated through the relationships and interactions among learners and instructors.

The term “online” covers a range of areas such as informatics, computer-assisted instruction and computer-mediated conferencing Salmon (2000). In a fully online course, students can only interact with other students and instructors via the use of information and communication technology. In fully online courses, interaction has been recognized as the most significant factor which impacts student learning (Maor & Volet 2007). Online learning environments can be defined as places where learners and teachers interact with the use of an Internet-based program or system that uses the attributes and resources of the World Wide Web to facilitate learning (Jarrahi 2010). Hence from the above discussion it is evident that interaction between students and instructors is an important factor in teaching and learning online and the quality of this interaction determines the success of the learning.

## **2.2 Interaction**

Interaction has long been a critical component of the educational process, whatever the classroom context (Anderson 2003). Interaction can be defined as a communication between students and instructors which enables the students to get closer to achieving their educational goals (Nandi, Hamilton & Harland 2012). Interactivity implies the existence of communication channels between actors. In a classroom environment, the actors are the teachers and the learners. Both the conversation theory of learning of Pask (1975) and social constructive learning theory of learning with technology of Brown and Campione (1996) emphasize that successful learning requires continuous conversation and interaction, not just between teachers and learners, but also amongst the learners.

Individual students in a fully online environment are used to working by themselves in isolation without social support and group feedback (Benbunan-fich & Hiltz 1999). Depending on the difficulty of the task, these elements may increase anxiety and uncertainty. Interactive activities can support learning in various ways such as:

- providing an opportunity for evaluation and feedback in which students can develop individual thinking and provide feedback for clarification and modification (Dillenbourg & Schneider 1994);
- providing an opportunity for exposure to alternative points of view that can challenge understanding and motivate learning (Glasser & Bassok 1989);
- allowing to have a group structure that provides social support and encouragement for individual efforts (Alavi 1994; Webb 1982).

Recently, Persico, Pozzi and Sarti (2010) have recognized interactivity amongst learners and instructors as an important aspect in online learning. Online interaction among course participants is a critical feature of online teaching and learning (Gosmire, Morrison & Osdel 2009). Online student engagement can be defined as the effort (in terms of time spent) and perseverance which learners

devote to activities that enable them to achieve their learning goal (Postle et al. 2003). Researchers affirm that student interaction is a strong predictor of learner achievement and development (Baker, Speiezio & Boland 2004; Kuh 2003).

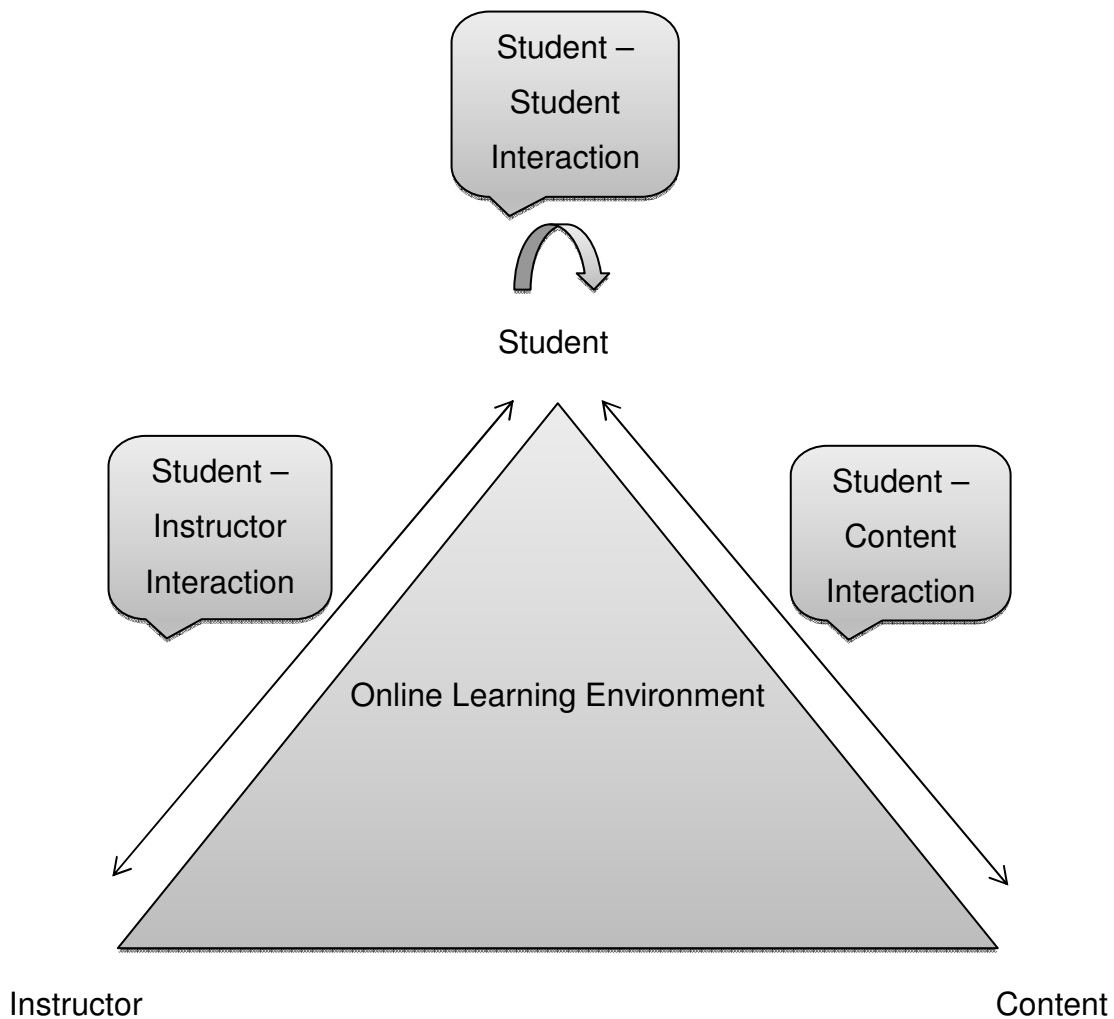
Online teaching is not about broadcasting. Two-way communication is required to ensure interactivity similar to on-campus classroom learning environments. Consequently, educators should consider interactivity when designing online learning strategies (Maor & Volet 2007). The role of teaching is not simply to convey information but rather to engage learners in actively constructing knowledge (Al-Mahmood & McLoughlin 2004) and become “facilitators of learning” as opposed to “deliverers of content” (Naidu, Cunningham & Jasen 2002). The way instructors intervene in the online interaction can set up directions for discussion and define boundaries. Interaction with instructors includes the methods by which instructors teach, guide, assess and support students’ learning and construct knowledge (Albion & Ertmer 2004) and is one of the most critical factors in enhancing student satisfaction in an online course.

Moore (1993) and Clayton (2004) distinguish between the three major types of interaction (Figure 2-1) in online courses:

- (1) student-student interaction
- (2) student-instructor interaction
- (3) student-content interaction.

Hence the learning process is no longer an individual endeavor and should incorporate and leverage the many-to-many relations among learners and instructors (Piccoli, Ahmad & Ives 2001). Dennen and Wieland (2007) state that learners should interact with each other and course material at deep levels, which lead toward negotiation and internalization of knowledge rather than just rote memorization of knowledge. Interactive activities are an important aspect of online learning collaborative learning as they enhance learner understanding of the subject material.





**Figure 2-1 Types of interaction in fully online courses (Moore 1993, Clayton 2004).**

The learning system not only acts as a tutor, it also acts as an assistant, communication medium and a guide for the users to create the real life interactive classroom atmosphere (Sharples 2000). In addition, Murphy (2004) reiterates the importance of promoting collaborative and peer-to-peer interaction when using online discussion forums. These definitions highlight the importance of interaction, acting and reflecting actively in online environments. One way to provide online interactivity for learners is via the use of online discussion forums.

## ***2.3 Use of Discussion Forums***

Discussion forums are widely used communication tools within an online learning environment and significantly shape the types of communication that take place. To support ongoing online interaction, asynchronous (newsgroups, wikis etc) and synchronous (Elluminate, Skype etc) discussion forums have been used because of their potential benefits (Sher 2009; Bradshaw & Hinton 2004). Discussion forums provide an effective opportunity to exchange ideas and share knowledge amongst learners and instructors (Tallent-Runnels et al. 2006; Levine 2007). Asynchronous discussion forums are generally preferred by the students over synchronous discussion forums. Synchronous discussions can be arranged in online courses through the use of tools such as “Blackboard Chat”, “Elluminate” and “Skype”. Skype is freely available software that allows users to make audio and video calls over the Internet. “Blackboard Chat” and “Elluminate” are tools for arranging virtual classrooms or meetings that have real-time audio and video enabled facility for discussion. However in synchronous discussion forums, it is not always possible for all students to participate because of time commitments (Nandi et al. 2011). Hence synchronous discussions in online courses often attract low student participation.

The use of asynchronous discussions reinforces the learning experience by providing the critical and flexible student–student and student–instructor interaction in fully online courses (Baker 2011). This type of system facilitates the requirements of people with family and work responsibilities, transport problems and physical disabilities to have quality education online (Sher 2009).

Discussion forums have frequently been used successfully as communication tools in online learning environments to facilitate interaction between students to share knowledge (Rovai 2002; Bradshaw & Hinton 2004; Berner 2003). There are many reasons behind the wide adoption of online discussion forums, but the major attribute of a discussion forum is the asynchronous nature that enables

learners and instructors to communicate with each other at any time of the day, and without having to find the time for person-to-person interaction. In addition, posting on a forum enables the discussion to be public and accessible by all other students in their own time.

From academics' points of view, online discussion forums provide a platform for incorporating and sharing knowledge, deriving and analysing solutions for different problems. Learners may be requested to participate in online discussions for multiple reasons. In online courses, learners are encouraged to participate in discussion forums to demonstrate their capability to carry on a discussion and to demonstrate their knowledge of a topic.

On the point of participation, a few authors, including Berner (2003) and Laurillard (2002), note that participation is more active if some sort of assessment is linked to it. Incorporation of assessment of participation has positive impact on learning outcome (Klisc, McGill & Hobbs 2009). Whether courses are completely or partially online, Burkett, Leard and Spector (2004), Leh (2002) and Seo (2007) all indicated how grade points might be used as an incentive to enhance participation between learners. However, for assessment of discussion forum participation to work effectively, there needs to be a comprehensively defined framework that can assist the evaluators and students clearly. Having a comprehensive framework can also act as a guideline for participants and educators.

The use and benefits of discussion forums vary immensely, covering topics as diverse as student- and teacher-lead discussions, debates, collaboration around set tasks and projects and set activities (Berner 2003; Rovai 2002; Rovai & Jordan 2004; Bradshaw & Hinton 2004; Gerbic 2006). Forums are also used for posting comments on readings, prior to submitting a formal review of the reading, as a memory trigger (looking back at old discussions), to find role models, to get some form of immediate peer review, or for making connections with each other.

These activities allow learners to think critically, discuss the topic intimately and learn from others.

The above mentioned benefits can provide quality online engagement. Past research has shown that participation in online discussion forums is not always equal (Poole 2000; Guzdial & Carroll 2002; Leh 2002; Russo & Benson 2005; Salmon 2003). Johnson (2007) and Salmon (2003) have classified online participation by grouping them as “Lurkers”, “Members” and “Experts”:

- Firstly some are “lurkers” i.e. who just read the messages and do not participate. They may learn by reading the posts and incorporating the ideas into their assignments (Guzdial & Carroll 2002).
- Secondly some learners read the messages and treat them as a notice board posting their own position which indicates limited interactivity.
- Thirdly the participation is interactive and consistent (Ho 2002).

The above mentioned models of student participation in online discussion forums provide an outlook for the expected behaviour of online students and they need to be investigated with fully online students.

## ***2.4 Diversity in Online Engagement***

The diversity in participation has been investigated by several researchers who reported that the maturity and motivations of learners have an impact on their online engagement (Nguyen, Nandi & Warburton 2011; Sheard, Ramakrishna & Miller, 2003). On this issue of motivation, Weaver (2005) has identified the main motivators and de-motivators for student participation in discussion forums.

Motivators are:

- Interest in the course and deeper exploration of concepts
- Being able to learn from others
- Desire for insight into assessment and academic improvement
- Exchanging opinion and advices with others

- Feedback from moderators

De-motivators are:

- Access of technology and forum layouts
- Irrelevant discussion topics, meaningless messages and personal discussions
- Time pressures
- Non-participation by others
- Arrogant contributors
- Lack of confidence in posting for fear of looking silly

Gerbic (2006) identified the following factors that impact the participation in online discussion forums:

- The absence of spontaneous exchanges
- Too much information and most of which is trivial
- Anxiety about posting messages due to their performance
- Interest in the topic
- Assessment of the discussion
- Voluntary or mandatory participation
- Satisfaction with the current interaction
- Program structure
- Familiarity with the discussion topic
- Confidence in their topic expertise
- Understanding the role and value of online discussions

Ensuring all these motivating factors does not necessarily guarantee effective online communication. Wilson and Stacey (2004) point to another important fact that small group participation is more likely to be successful rather than whole class so that they are more comfortable with each other to share their views freely. Again Dysthe (2002) places the focus on teacher presence in online

forums and states that teacher presence is necessary, although if the teacher does not participate it provides the students opportunities for more informal interaction.

The phenomenon of “lurkers” is most evident in educational discussion forums where participation and engagement is not compulsory (Sheard et al. 2003; Sheard, Ramakrishna and Miller 2003). Participation by learners is never guaranteed, especially by those who fail to understand the benefits gained and thus demonstrate their uncertainty by not actively participating in the discussions (Armatas, Holt & Rice 2003). Research suggests that the strongest motivator for participation is with some form of assessment as learners generally perceive that what is valued is what is assessed (Burkett et al. 2004; Laurillard 2002; Leh 2002; Ramsden 2003; Sheard, Ramakrishna & Miller 2003; Seo 2007). As pointed by Framer (2004), the lack of guidelines outlining mechanisms for ensuring productive discussion through participation in forums results in ineffective discussion forums. Allocating marks or grades is suggested to make sure that learners participate in the discussion forums (Sheard, Ramakrishna & Miller 2003). Assessing the quality of posts is difficult and instructors often look at quantity as an indicator of participation (Dooley & Wickersham 2007). Research has shown that participation is not always welcome by students who fail to understand the benefits gained and thus demonstrate their uncertainty by not actively participating in the discussions because of the lack of standard guidelines (Dennen, Darabi & Smith 2007, Armatas, Halt & Rice 2003; Ramsden 2003; Farmer 2004).

Designing and assessing participation in asynchronous discussions of the students is a major challenge (Liu 2007). This issue of assessment of student participation in the online discussion has been a heated topic among educators and researchers in online education (Bonk & Dennen 2003). While there is some literature in this regard, there is a lack of empirical studies (Ho, 2002).

Sheard et al. (2003) carried out research in a blended learning environment to investigate patterns of student usage of the online environment and identified in which areas students access and spent most of their time. Research carried out by Nandi et al. (2011) reported the general level of activity of the students in fully online courses. They also suggested that there are several factors which might affect the activity and the achievement of the students in fully online courses. Some of the factors are impact of content, difference of tutor support, the way content and expectation is managed and role of the instructors.

Having presented various perspectives on the importance of interactivity when using online discussion forums in higher education, we will now concentrate on the criteria that lead directly to our proposed framework that will support educators in their design and assessment of quality in online discussion forums.

For assessment of discussion forum participation to work effectively, there needs to be a comprehensively defined framework. Having a comprehensive framework can also act as a guideline for participants and educators. Brannon and Essex (2001) recommend that there is a need for clear communication protocols and requirements for posting and suggest that the continued development of an innovative evaluation framework is necessary to improve the quality of contributions to an online discussion. A rubric that explicitly describes levels of responses will stimulate learning by challenging students to reflect and think critically, rather than post basic statements of understanding and mere opinion (Anderson & Krathwohl 2001).

A comprehensive framework with a set of criteria is therefore required for fully online courses to ensure effective and quality interaction as it makes explicit to students the expectations of their engagement in discussions, and thereby shapes that engagement (Jackson 2010). We need to address how “quality of interaction” can be defined and what are general criteria for quality online interaction for both students and instructors.

## ***2.5 Defining Quality in Student Interaction***

When talking about students' engagement, Biggs and Tang (2007) point out that one of the three main factors teachers face in supporting students to learn better relies on their levels of engagement. Clayton (2004) developed an instrument consisting of eight scales to measure the effectiveness of strategies employed in designing an e-learning environment. They were:

- Computer Competence
- Material Environment
- Student Collaboration
- Tutor Support
- Active Learning
- Order and Organization
- Information Design
- Appeal and Reflective Thinking

It is difficult to design and evaluate the participation in discussion forums because of the lack of standard guidelines. Different tools (Clayton 2004; Stern & Lim 2007; Sheard et al. 2003) have been used to evaluate the issues related to e-learning systems. For example, traditional survey methods can be used by logging key points like the frequency of use of a site, the time spent on a particular site, the resources that are browsed and the pattern of use by students through the year (Sheard et al. 2003; Stern & Lim 2007). Analyzing the student's behaviors in this way provided the educators an idea of what and how the students use the online resources for learning.

These tools mentioned above mainly provide a measurement for the overall use of online discussion forums. Quality of discussion has been investigated and measured by several researchers from different angles- tone (Grady 2003;



Knowlton & Knowlton 2001), grammar (Edelstein & Edwards 2002), number of words (Biesenbach-Lucas 2003), reasoning (Edelstein & Edwards 2002; Love 2002), level of controversy (Burstall 2000) and content (Blignaut & Trollip 2003; Edelstein & Edwards 2002; Grady 2003; Im & Lee 2003–04; Merryfield 2001). The result of these investigations suggests that posts are not always clearly understood by everyone (Love 2002) and enhanced interaction often occurs when controversial issues are discussed with participants constantly disagreeing and clarifying (Blignaut & Trollip 2003; Burstall 2000).

Garrison, Anderson and Archer (2000, 2001) developed a practical inquiry model that reflects the critical thinking process in asynchronous text-based computer-mediated communication. According to this model, critical inquiry is presented in a sequence of four phases, which are the triggering event, exploration, integration and resolution. However it may be difficult to assess quality of posts using this model as it is phase specific. From our earlier discussion we have seen that not everyone participates equally or at the same pace and rate. The criteria presented in the enquiry model can be considered independently for assessing discussion forum posts.

Henri (1992) developed a tool for online discussion analysis with five dimensions and suggests that it can be used to effectively classify electronic messages namely. Although Henri's model provides an initial framework for analysing discussion forum contents, it lacks detailed criteria for systematic and robust classification of electronic discourse and requires further empirical research to verify its applicability (Howell-Richardson & Mellar 1996; Hara, Bonk & Angeli 1998). Another model by Newman, Webb and Cochrane (1996) defines ten criteria for assessing the dimensions for cognitive skills. This model (referred as Newman's model) focuses on the 'answers' rather than the ongoing interaction that should be the mainstay of interactive online discussion forums. This model does not provide any criteria for issues such as the frequency and consistency of posts and use of informal or formal language.

## ***2.6 A New Conceptual Framework for Interaction among Students***

Drawing from both Henri's, Newman's and Garrison's models, we developed a framework with a set of criteria (Table 2-1) and categorised them for design and assessment of discussion forum participation (Nandi, Chang & Balbo 2009; Nandi et al. 2012). This type of categorization was also used by Hew and Cheung (2003) while evaluating the participation and quality of thinking of pre-service teachers in online interaction. In order to assess each criterion we separate the above criteria into three broad categories:

- Content: demonstrating the expertise of the learners in the discussion topic and by which the talent of the learners can be assessed.
- Interaction Quality: the way learners interact with each other online in a constructive manner which implies that the contribution should be collaborative and meaningful for the community of learners.
- Objective measures: how consistently or frequently learners participate in discussion.

In order to fully support educators, our framework (Nandi Chang & Balbo 2009; Nandi et al. 2012) also provides a sub categorization which clearly indicates what may be poor, satisfactory, good or excellent performance against each criterion. However, the relative importance and relevance of the criteria that follow depend very much on the facilitators, the subject matter or discipline area, and the cohort and demography of the learners they are assessing. The indicators of what can be considered as poor, satisfactory, good or excellent performance will vary depending on the educators' teaching and learning experience and general perception. The detailed framework is presented in Table 2-1.

Criteria	Poor	Satisfactory	Good	Excellent
<b>Content</b>				
Clarification	Regurgitation of information	An clear explanation of available information	Explaining available information using relevant examples	Articulating available information to expand on ideas presented, including the use of examples
Justification	No justification of points	Justification based on personal opinion	Justification using existing cases, concepts or theories	Justification using existing cases, concepts or theories and providing clear discussion of implications
Interpretation	Misrepresentation of Information	Basic paraphrasing of available information	Clear interpretation of available information	Critical discussion of available information
Application of Knowledge (Relevance)	No application or discussion of relevance to questions asked	Application of knowledge to questions asked	Application of knowledge including discussion using relevant examples	Knowledge is critically applied and may include discussion of limitations

Prioritization	No prioritization of information or knowledge	Some basic comparison of information	Ability to prioritize information and knowledge	Ability of prioritize information and knowledge based on criteria that learner has established
Breadth of Knowledge	Narrow and limited knowledge	Some indication of a wider view of the topics discussed	Presenting a wider view of the topics discussed by showing a good breadth of knowledge	Ability to point out other perspectives, including drawing from other fields of studies
<b>Interaction Quality</b>				
Critical Discussion of Contributions	No engagement with other learners' contributions	Some basic discussion about other learners' contributions	Consistent engagement with other learners' contribution and acknowledgement of other learners' comments on own contributions	Contributing to a community of learners, with consistent engagement and advancement of each other's ideas

New Ideas from Interactions	No evidence of new ideas and thoughts from interaction	Some new ideas developed as a result of interaction	Some solutions and new ideas as a result of interactions	Collaborative approach to solution seeking and new ideas developed
Sharing Outside Knowledge	No sharing of outside knowledge	Sharing generic information that is easily available from outside sources	Sharing real world examples that may not be immediately obvious to other learners	Sharing real life knowledge, personal experience and examples of similar problems/solutions
Using Social Cues to Engage other Participants	No engagement with others in the discussion forum	Answering some basic question posed by facilitator or other learners	Engaging with the work and discussion of other learners	Engaging and encouraging participation with fellow discussants in the forum
<b>Objective Measures (this category is subject to facilitators' expectations)</b>				
Participation Rates	None or less than 2 posts per week	Between 2 to 5 posts per week	Between 5 to 10 good quality posts per week	More than 10 good quality posts per week
Consistency of Participation	Rarely posts with occasional activity	Occasional Activity	Consistent Activity	Consistent and Productive Activity

**Table 2-1 Conceptual framework for assessing quality in online discussion forums (Nandi, Chang & Balbo 2009; Nandi et al. 2012).**

Hence the question arises, *can this framework be used for design and evaluation of online interaction for computing students in a fully online learning environment?*

While this framework looks at the quality of interaction related to the student participation, it does not provide guidelines about how student – instructor and student – content (Moore 1989) interaction should be designed to ensure enhanced quality student interaction. In addition, the criteria in this framework were derived through research into blended learning environments (Nandi et al. 2012). Hence this framework needs to be tested within fully online learning environments.

Although this framework provides an overview for designing or assessing the participation of students in discussion forums, it does not specify the guidelines for the role of the instructor in this process.

Research conducted in this area has shown that both student – student and student – instructor interactions are significant contributors to the level of student learning and satisfaction (Sher 2009). There is a need for evaluation of the role of the instructor in online discussion and its impact on overall student interaction.

## ***2.7 Instructor Contribution***

The term instructor, moderator and facilitator are often used inter-changeably in practice and in the literature. In this research we have used the term “Instructor”. Interaction with instructors refers to the methods by which instructors teach, guide, assess and support students’ learning (Albion & Ertmer 2004) and is one of the most critical factors in enhancing student satisfaction in an online course.

Instructors have an important role to play so that collaborative and interactive participation by the students can be ensured (Meyer 2002). Researchers suggest that web-based learning presents a more customized format in which instructors must interact with each student (Wagner 2001). Volery (2001) and Meyer (2002) also emphasized the role of the instructor for quality learning in online systems and termed the role of the instructor as “learning catalyst and knowledge navigator”.

Student – instructor interaction is one of the most critical factors in enhancing student satisfaction in an online course. Communication and interaction is critical in any form of education. Students and instructors must find ways to convey information, determine level of understanding, and create a workable feedback system (Sher 2009). In a traditional on-campus face-to-face learning environment, students’ facial expressions usually provide a clue if students are confused. However, in an online environment, if students are confused, there is no way to detect this unless they choose to communicate their confusion. Interactions between students and instructors help students clarify and obtain a correct understanding of the course content (Thurmond and Wambach 2004). Baran, Correia and Thompson (2011) suggest that because online students are expected to take greater control of their learning process and be more active in stimulating their peers’ learning, facilitation of online learning emerges as an important role in guiding these student-centred approaches.

Considering the importance of the task of the instructor in online interaction, the student-student interaction cannot be designed without taking into account the student-instructor interaction. The instructor’s role in asynchronous discussion forums can vary from being the ‘sage on the stage’, to the ‘guide on the side’ or even ‘the ghost in the wings’ (Mazzolini & Maddison 2003). Discussion in the literature generally suggests that it is important that instructors play an active, visible part in forum discussions (Salmon 2000). Hence it is natural to ask what

that ideal role should be for an instructor, and in particular *how can we define guidelines for participating in ongoing discussion in a fully online course?*

Conducting online discussions involve the instructor acting as tutor, facilitator and subject expert, and that this flexibility across the roles is a significant factor in developing engagement and interaction (Garrison & Anderson 2003). These include asking a question at the beginning to prompt discussion, letting students answer questions and extending discussion by providing hints.

Steel (2009) has investigated the level of adaption of learning management systems to ensure collaboration by instructors. Cheung and Hew (2010) explored how habits of mind of the facilitators influence student participation. Through an extensive literature review Baran, Correia and Thompson (2011) identified the ideal role of an online instructor as:

- Managerial
- Instructional design
- Pedagogical
- Technical
- Facilitator
- Social

Davidson-Shivers (2009) conducted a study and examined the frequency and types of instructor-student interactions. The study reported that there are basically five types of information shared with students by the instructors. They are:

- Content: information related to the content of the course
- Course assignment: information regarding the completion for the assignments
- Technical issues: information related to the use of the technology
- General information: general information about the course



- Other: information not related to the course content but about socializing or related to student and faculty work

This set of criteria can provide guidelines for the type of information the instructor needs to convey towards the students, but it does not provide the principles for instructor participation in an ongoing discussion about certain specific topics and how to inspire the students or extend discussion towards quality interaction.

Research conducted by Mazzolini and Maddison (2007) showed that, according to the students, the role of an online instructor would be to incorporate the following five features:

- (1) ask follow up questions while answering one;
- (2) introduce new concepts or new angles of thinking about solutions;
- (3) answer questions as soon as possible;
- (4) provide feedback;
- (5) discuss different solutions provided by the students.

However, instructors classified most of their participation in the following three categories (Mazzolini & Maddison 2007):

- (1) answering students' questions;
- (2) asking leading questions;
- (3) while responding to a student's question, asking subsidiary ones in order to continue the discussion thread.

One school of thought proposes that instructors are critical to the success of an online discussion (Blignaut & Trollip 2003; Ferdig & Roehler 2003–04; Figallo 1998; Greenlaw & DeLoach 2003; Knowlton & Knowlton 2001; Love 2002; Moller 1998; Roblyer & Wiencke 2003). The educator is there to raise the discussion to a higher level (Figallo 1998). Moreover, giving students the responsibility to determine the direction of discussion is not a viable approach (Moller 1998).

The other school of thought claims that instructors should take a back seat and let students construct their own knowledge (Burstall 2000; Li 2003; Mazzolini & Maddison 2003; Poole 2000; Rourke & Anderson 2002).

The above discussion represents contradictory opinions among researchers on how instructors should be facilitating a discussion forum which provides the backbone of a fully online course. Blignaut and Trollip (2003) summarize by saying that our understanding of how to design online discussion in an effective and meaningful way is still limited.

The question remains whether this 'sage on the stage', to the 'guide on the side' or even 'the ghost in the wings' (Mazzolini & Maddison 2003) role of the instructor can ensure quality discussion by the students or not. Through this research we intend to identify the ideal role of the instructor in discussion forums in fully online courses. A structured framework would also assist in defining roles if multiple instructors or tutors are involved (Goold, Coldwell & Craig 2010).

From the above discussion the research question arises: *how can the student – instructor interaction be designed for effective learning?*

While we have discussed the idea of student – student and student – instructor interaction is critical to all instruction, the importance of organizing the course so that student engagement with the content of the course is achieved and continued must not be taken lightly (Moore 1993). Hence there is a definite need to investigate the content management for effective learner-content interaction.

## **2.8 Student – Content Interaction**

Interaction with content refers to the students' engagement with instructional information (Albion & Ertmer 2004). Little or no learning will occur without

effective student – content interaction (Moore 1993). Research has shown that student – content Interaction is the primary construct in predicting online satisfaction (Strachota 2006). Content interaction is critical because student – content interaction is the key way in which students acquire new knowledge, skills, and abilities (Northrup 2001), changing their understandings and perspectives.

Consequently there is a need to investigate how the student – content interaction can be designed. This issue becomes even more important when dealing with fully online introductory computing students who may have little or no previous experience of using online study mode and hence unfamiliar with the environment.

Gosmire, Morrison and Osdel (2009) examined the student-to-content interaction and reported that females perceive interaction significantly more favorably than their male colleagues. Perhaps this can best be explained by a difference in learning preferences or in the different professional experiences of the female learners. Hence the design for content management should be flexible to support different types of students and their interactions with the content.

Learners with different preferences might prefer to work in different ways with particular types of content (Wilson & Albion 2009). For example, certain skills might be best learned through individual practice but more conceptual material might be better handled through discussion with peers. Hence it is possible to conceive of a typology of course design in which the type of content might be a factor (Albion & Ertmer 2004).

Learners appreciate variety in the activities through which they engage with the content (Wilson & Albion 2009). Those in this study seemed to find that learning and assessment activities that required them to demonstrate, apply and analyze course content were more likely to be associated with high levels of interaction.

In broad terms, the processes of online teaching break into design perspective and method of delivery. Compared to regular classes, online courses impose stricter requirements for planning and design to be completed well in advance of the activity so as to avert problems that can arise with the technology such as Blackboard and Moodle (Wilson & Albion 2009). Instructors need to be prepared and check courses to limit the risk of students encountering problems in the absence of instructional support.

Introductory computing students who are new to online courses may benefit from opportunities for familiarization with systems, updating of computer skills, and development of self-awareness about learning preferences. Because of the importance of course design in online teaching, teacher preparation should include opportunities to design and develop courses that apply these understandings.

Universities use various content management systems to manage learning-related materials and student-learning processes (Malikowski 2008; Malikowski, Thompson & Theis 2006; West, Waddoups & Graham 2007). These content management systems consist of a variety of technical capacities to support online learning. Among the factors in successful online-learning experiences, student – content interactivity remains the central one (Chou, Peng & Chang 2010). They further state that a well-designed content management system can help enhance student – content interaction by providing various facilities such as online quizzes for student self-evaluation, FAQs regarding content and assignments, study guides and links to other educational systems to better engage students in the learning content. The study by Chou, Peng and Chang (2010) mainly used quantitative data and analysis to measure the distribution of student interaction with content and did not conduct qualitative analysis of the views of the students.

Current methods of content design limit in empowering students with tools that they can use independently to support self-governed and problem based activities (Dalsgaard 2006). With their current limited tools, traditional content design and management techniques also restrict the instructors in designing more student-centred courses and activities with dynamic content navigation (Siemens 2004). Lack of student – content interaction is a major weakness in current learning management systems (Yasar & Adiguzela 2010). Since learning management systems initially emerged as document repositories, interactive learning support is not being reached as expected as it was not utilized up to full potential (Kemp & Livingstone 2006).

Researchers argue that course management systems should be flexible enough to provide better quality, learner-centred education and hence deliver independent and active students (Vovides et al. 2007). Vovides et al. (2007) also point out that in spite of this potential to improve learning by means of using fully online environments for the delivery of e-learning, the features and functionalities that have been built into these systems are often underutilized. As a consequence, learning environments do not adequately scaffold learners to improve their self-regulation skills. In order to support the improvement of both the learners' subject matter knowledge and learning application, the content management systems should be designed to address learners' diversity in terms of learning preferences, prior knowledge, culture, and self-regulation skills.

Research findings also reveal that student – content interaction is problematic for students when the systems' features do not function properly. Functionality can be defined as good design, implementation (compatibility and reuse), tailored curriculum and intelligent analysis, high availability, and security all of which must function well (Abitt 2006). The integrated features and functionalities are often underutilized which may not impact the learning of in-class students, but have a negative effect on the learning of students enrolled in fully online courses (Vovides et al. 2007).

Current designs for content management systems have a lack of robustness to offer extensive support for learning (Dabbagh 2004; Mitrovic et al. 2004; Swenson & Curtis 2004). All students have access to the same instructional material and the same web-based tools without personalized support (Brusilovsky 2004). In order to provide effective interaction with content, these built-in functionalities should be exploited to offer students a flexible and adaptable learning experience based on the individual student's learning skills (Darbhamulla & Lawhead 2004).

Student – content interaction can be in the form of reading a book and writing a summary, watching a multimedia lecture and answering questions about the content, and so on (Dunlap, Sobel & Sands 2007). However, in order to learn, students must have a deep and meaningful interaction with the content and instructors must present content in a way that will motivate and inspire students to think deeply about it (Jensen 1998).

However, there appears to have been little research published about the relationship of content to course design and consequent outcomes for learners (Wilson & Albion 2009). Researchers agree that it is challenging to accomplish the perfect student – content interaction (Dunlap, Sobel & Sands 2007). As fully online systems should provide a typically student-centred environment, research needs to be carried out to find out what critical criteria need to be considered for designing effective student – content interaction.

From the above discussion the research question arises: *how can we design online content management strategy for effective student – content interaction?* There is evidence for the value of accommodating student preferences in course design but further research is needed into how student preferences align with various aspects of course design (Wilson & Albion 2009).

## ***2.9 Importance of Interaction in Online Computing Courses***

The opportunities presented through the emergence of online learning have been recognized by educational institutions worldwide. Hence it has become critical for educators and universities to investigate the challenges of fully online computing courses.

Computing courses are considered as an area of instruction requiring conceptual knowledge and understanding and is highly technical and practical in nature (Gulatee & Combes 2006). The objective of computing courses is to teach students how to develop competence in cognitive areas such as syntactic and conceptual knowledge (Linschner 2002). Students are required to learn how to develop strategies to creatively solve programming or IT related problems (Bayman & Mayer 1998). Deek and Espinosa (2005) found that most students find introductory computing courses frustrating and difficult to learn. Research carried out by McSporran and King (2005) shows that students in computing courses have difficulty visualizing abstract concepts.

Students find computing units extremely challenging even in a traditional on-campus environment whereas in fully online environment, being physically isolated, teaching and learning becomes even more difficult (Gulatee & Combes 2006). Studying computing courses online are difficult as these are required to be carefully designed with proper attention to human – computer interaction (Deek & Espinosa 2005).

In online computing courses, students find it more difficult to understand complex concepts, technical knowledge and applications of the theory of programming to problem-solving exercises than on-campus students, who have the benefit of face-to-face feedback from their instructors and peers (McSporran & King 2005). Therefore, computing students are at significant risk when attempting an online course compared to traditional classroom students because of the lack of

interaction (Gulatee & Combes 2006). Yang and Liu (2004) investigated the best practices of teaching and learning in computing courses and suggest that to be successful students need to learn collaboratively in an interactive environment which mimics the workplace; participate in active learning to develop technical skills and knowledge; and engage in conceptual discussions with their peers and instructors.

Student learning in fully online courses is also impacted by the way instructors conduct and interact in these courses. Researchers suggest that teaching online is different to the on-campus environment and is more challenging as the role of instructor affects student satisfaction and interaction (Gulatee, Brown & Combes 2008; Combes & Anderson 2006).

Instructors in computing well aware of the difficulties many beginners encounter in learning IT concepts, computer algorithms and programming concepts because they cannot figure out the diverse dimensions of IT studies and the steps a computer program takes to solve a problem (Cooper, Dann & Pausch 2000). In a traditional face-to-face environment, students work in groups and share ideas and resources among peers and instructors. It is a major challenge to set up an online environment through which similar sorts of interactions and activities can be facilitated. Gulatee, Brown and Combes (2008) summarize that communication and interactive learning play an important role in the online learning environment and hence computing courses must include strong collaborative learning opportunities among students and instructors to develop problem-solving skills and apply complex theory to practical applications.

The above discussion highlights the importance of conducting research on interactions in fully online computing courses. Accordingly, in our research, we focus on interaction quality of fully online computing courses by investigating the following research question:



*How can we develop design principles for quality online interaction in fully online computing courses?*

The specific questions are:

- 1. What are the important factors that affect student activity in fully online courses?*
- 2. How can we evaluate quality interaction between students in fully online courses?*
- 3. How can we define the appropriate criteria for the instructor to interact with the students in fully online courses?*
- 4. What factors need to be considered for designing effective student – content interaction in fully online courses?*

There has been limited investigation about how effective quality interaction can be designed in fully online computing courses which indicates the timeliness of this research.

## **Chapter 3 - Methodology**

The primary drivers of our research design are the main and specific research questions. This chapter presents the nature of the research; the drivers of the research design; the research design itself; how we addressed the requirements for rigour, relevance and credibility in this research, and the boundaries of this research.

### ***3.1 Nature of Research***

The principal objective of undertaking any research is to contribute to knowledge and is based on underlying conventions about the nature of reality and how knowledge about reality can be obtained (Hirschheim 1992). As mentioned previously, our primary aim of undertaking this research is to contribute towards the knowledge about student interactions in fully online computing courses. Hence we intend to develop a framework for the three types of interaction i.e. student – student, student – instructor and student – content through this research. In that respect, this research can be characterized as Computer Science educational research.

Educational research has been defined as a variety of methods which is used to evaluate different aspects of education such as student learning, teaching practices and classroom dynamics (Lodico, Spaulding & Voegtler 2010; Anderson 1998). Educational research attempts to solve a problem by gathering new data from primary or first-hand sources or using existing data for a new purpose (Anderson 1998). Anderson (1998) further states that educational research emphasizes the development of principles or theories that will eventually help in understanding, prediction and/or control. Salomon (1991) suggests that

educational research leads to the implementation and dissemination of innovative educational practices.

To carry out this educational research, we initially analyse the existing distribution of student participation in two fully online courses (Nandi et al. 2011). In order to analyse and evaluate the student – student interaction, we develop a framework (Nandi, Chang & Balbo 2009) through extensive review of literature which is presented in Table 2-1. Then we collect data from discussion forums and through surveys to evaluate the framework (Nandi, Hamilton & Harland 2012). In order to investigate student – instructor interaction, we identify a set of criteria through literature review and organise a new framework by collecting and analysing data from discussion forum (Nandi, Hamilton & Harland 2012). We then evaluate the framework by surveying the students and analysing their responses. In order to investigate student – content interaction, we constructed a survey, analyse the responses and develop a set of guidelines. The detailed stages of our research including data collection and analysis processes are explained in this chapter.

### ***3.2 Quantitative and Qualitative Data***

An important dimension of research is whether it is quantitative or qualitative for both data collection and analysis. The qualitative method is concerned with exploring and investigating obscure problems and understanding the reasons behind the phenomenon (Laws & Mcleoad 2004). This approach is focused on human behaviour and artefacts. Data for qualitative analysis may be collected from a variety of different sources including interviews, observations, case studies, documents with the focus on gaining understanding and collection of rich information rather than identification and measurement of facts (Marshall & Rossman 2006, 2011).

Quantitative research is focused on collecting numeric data and analysing information techniques such as counting and statistics. Data collection for quantitative analysis is focused on the identification of variables and facts that can be measured, and then collecting those measures (Olson 2001; Estabrooks 2001). Common techniques for this collection include scales, tests, surveys, and questionnaires.

While quantitative research design strives to identify and isolate specific variables within the context, qualitative analysis is focused on a holistic view of what is being studied. Hoepfl (1997) states that where a quantitative research seeks casual determination, prediction and generalization of findings, qualitative research seeks illumination, understanding and extrapolation. Qualitative analysis results in a different type of knowledge than does quantitative inquiry.

Johnson (1995) suggest that researchers in technology education research engage in research for deeper understanding rather than examining surface features and qualitative methodologies are powerful tools for enhancing the understanding of teaching and learning. Bryman (1984) states that qualitative research is deemed to be more flexible for educational research than quantitative research in that it emphasizes discovering novel or unanticipated findings. Lechner (2001) emphasizes the use of qualitative approach and suggests that exploring students' perceptions lends itself to a qualitative research methodology, the focus of which is "understanding" rather than measuring. Lechner (2001) further notes that qualitative research goes beyond reporting what people say to why they are saying it. However both types of approaches have advantages and disadvantages. Hence some researchers believe that qualitative and quantitative research can be effectively combined in the same research project (Strauss & Corbin 1990; Patton 1990). Russek and Weinberg (1993) claim that by using both quantitative and qualitative, their study of technology-based materials for the elementary classroom provided insights that neither type of analysis could provide alone. By combining both methods, advantages of each methodology

complements each other and makes a stronger research design which results in valid and reliable findings (Laws & Mcleod 2004).

Barrow and Woods (2006) state that

*"Since educational issues are of many different kinds and logical types, it is to be expected that quite different types of research should be brought into play on different occasions. The question therefore is not whether research into teaching should be conducted by means of quantitative measures (on some such grounds as that they are more 'objective') or qualitative measures (on some such grounds as that they are more 'insightful'), but what kind of research can sensibly be utilized to look into this particular aspect of teaching as opposed to that." (P. 175)*

Our research design is influenced by this concept of mixed method research and hence we apply a combination of quantitative and qualitative approaches with most emphasis on the qualitative approach for our research.

The study of the initial activity of the students and their achievements follow quantitative approaches where the aim is to identify and isolate specific variables that impact their participation and achievement. At this stage, we investigate numbers and statistics such as the variation of the number of posts and accesses throughout the semester and try to identify the variables that influence these variations. Data for this quantitative analysis was downloaded from the learning management system and analysed by creating several graphs.

The investigations of the two frameworks are mainly carried out through qualitative analysis. In order to collect data, we also designed and conducted surveys. Surveys ask many respondents about their beliefs, opinions, characteristics, and past or present behaviour (Neuman 2006). As participants for this research are fully online students, surveys with mostly open ended questions were considered to be the most appropriate approach to collect data.

This also meant that fully online students located around different parts of Australia and around the world are able to participate in the research study.

One important aspect of our data collection and analysis approach is the sample size. It is generally perceived that sample size should be as large as possible for quantitative analysis. Larger and randomly selected sample size to conduct quantitative analysis ensures the generalization of the findings (Austin 1983). In the case of qualitative analysis, sample size should generally follow the concept of saturation i.e. when the collection of new data does not shed any further light on the issue under investigation (Glaser & Strauss 1967). Creswell (1998 p.64) and Morse (1994, p.225) suggested that intended sample sizes should be 20-30 and 30-50 participants or sets of data respectively if a grounded theoretic approach is followed. Atran, Medin and Ross (2005, p.753) suggested that in some of their studies "as few as 10 informants were needed to reliably establish a consensus". Mason (2010) investigated the sample sizes used for grounded theoretic studies undertaken at post-graduate level and reported that, just under half (49%) of the studies fell within Creswell's (1998) suggested range of 20-30; while just over a third (37%) fell within the range of 30-50 suggested by Morse (1994).

### ***3.3 Time Dimension***

Time is an important dimension of our research. We decided to use both longitudinal and cross-sectional approaches for our research. A longitudinal approach involves the collection of data at multiple points in time (Neuman 2006) which suited our approach for the quantitative part of our study as it allowed us to investigate distribution and differences in student participation. We employed the cross-sectional approach for the qualitative part of our study which involved observations and analysis at a single point in time and is valuable for

understanding exploratory or descriptive research (Neuman 2006) which suited our approach to investigate and develop the frameworks.

### ***3.4 Context and the Courses***

In order to conduct the research we chose two fully online introductory computing courses which had large number of students. The fully online courses offered by Open Universities Australia (OUA) ([www.open.edu.au](http://www.open.edu.au)) and conducted by RMIT University were Introduction to Programming and Introduction to Information Technology, both for first-year undergraduate and postgraduate students. Introduction to Information Technology (IT) and Introduction to Programming are the two common subjects taught to almost all the introductory computing students.

The Introduction to Programming course covers introductory concepts of programming through the use of the two programming languages Alice and Java. Students enrolled in this course are only from the Bachelor of Technology and Master of Technology degree.

The Introduction to IT course covers general IT concepts e.g. computer fundamentals, operating systems and applications, the Internet and spread sheets. This course has students from various degrees including Bachelor of Technology, Business IT, Indigenous Studies and Accountancy.

We investigate 5 study periods spread over 18 months for this research. As discussed in Section 3.3, time is an important aspect and a longitudinal study from multiple study periods provides more relevant results than one study period. We gathered data throughout all the study periods that we investigate and one (same) instructor was in charge of both the courses. Apart from one study period, the instructor was assisted by a number of tutors. All the course materials were

uploaded into the learning management system, Blackboard, before the start of the study periods. Students were provided with comprehensive directions regarding which topic would be covered in which study weeks. Assignments were uploaded into blackboard periodically and deadlines for assignment submissions were advertised clearly both in the course guide and in the General Discussion track.

Both courses were conducted in a fully online environment and there were absolutely no face-to-face classes. Both of the courses had online discussion forums where students were encouraged to participate and interact with each other. The courses had several different threads in the asynchronous forums, or separate discussion topics created by the instructor. For example, an “Introduction” or welcome forum, a “General” forum where the cohort discussed general course related issues, several small group discussion forums administrated by the tutors and forums to discuss the study “Materials” and assessment items for “Assignment 1”, “Assignment 2” and “Exam”. A number of changes starting with the allocation of assessment marks for discussion, and including the timing of assignment releases and the provision of the number of tutors affecting the student to instructor ratio were made during these 5 study periods.

Weekly synchronous chat sessions were organized by the instructor and tutors to discuss the study material for that week. These chat sessions were organized via Elluminate, a synchronous discussion tool with text, audio and video facilities which works in conjunction with Blackboard storing the recorded sessions with the discussion forums. Student attendance was very low in these chat sessions primarily because of their work and time constraints. Another reason could be the location of the students as they were located in many different parts of rural Australia and also spread out in several different countries of the world.



As mentioned above, several threads were created by the instructor in all 5 study periods to allow students to communicate via the online media. The threads were:

1. Welcome and Introduction: to allow students to introduce themselves which would make them known to each other virtually and take a step forward in creating a virtual community of learners.
2. General Discussion: to allow students to ask and response to questions about the general management of the course. Discussion in this thread mainly consisted of which programming language they should use and any problems in installing it, issues regarding navigating through the online environment, issues regarding how assessment would be done in the courses.
3. Assignment and Exam Discussion: the courses had separate threads for separate assignments and exam i.e. Assignment 1 thread, Assignment 2 thread, Assignment 3 thread and exam thread. Students and the instructor used this thread to ask and response to questions regarding general assignment issues, marking guidelines and clarification of questions. In the programming course, Assignment 1 and 2 were based on Alice programming language whereas Assignment 3 was based on Java. In the IT course, Assignment 1 was normally based on working and describing steps for simple image and audio editing, and Assignment 2 was based on writing small reports.

Assignments were normally released periodically for the both the courses i.e. Assignment 2 was released during the weeks when Assignment 1 was due and Assignment 3 was released in the weeks when Assignment 2 was due; However all the assignments were released together and during the first weeks for both Prog2 and IT2 (Table 3-1, 3-2).

4. Feedback: to allow students to provide overall feedback about the management and content of the course.

5. Group Discussion forums: these forums were administrated by the tutors (apart from Prog1, Table 3-1) and students used these forums to discuss weekly study materials. Students were divided into groups by the instructor, each group was assigned a separate tutor and each group had approximately equal number of students. Group discussion was assessed and based on the quality of discussion in Prog2, Prog3, IT1, IT2 and IT3 (Table 3-1, 3-2).

Course	Prog1	Prog2	Prog3	Prog4	Prog5
Study Period	Sep09- Nov09	Mar10 - May10	Jun10 - Aug10	Sep10 - Nov10	Jun11- Aug11
Number of Students	346	302	282	273	180
Number of Tutors (not the instructor)	0	2	2	2	2
Ratio of Student to Instructor (+Tutor) (approx.)	346:1	100:1	95:1	90:1	60:1
Group Discussion Marks	0	5	5	0	0
Assignments Released	Periodical	Altogether (in week 1)	Periodical	Periodical	Periodical
Pass rate	48%	52.86%	48.74%	46.43%	48%

**Table 3-1 Overview of the Programming courses.**

Course	IT1	IT2	IT3	IT4	IT5
Study Period	Sep09– Nov09	Mar10– May10	Jun10– Aug10	Sep10– Nov10	Jun11– Aug11
Number of Students	299	406	154	242	250
Number of Tutors (not the instructor)	2	3	3	2	2
Ratio of Student to Instructor (+Tutor)	100:1	100:1	40:1	80:1	83:1
Group Discussion Marks	10	5	5	0	0
Assignments Released	Periodical	Altogether (in week 1)	Periodical	Periodical	Periodical
Pass rate	49%	57.64%	48.75%	54.15%	51%

**Table 3-2 Overview of the IT courses.**

The main discussion board which consists of “Welcome and Introduction”, “General Discussion”, “Assignments and Exam” and “Feedback” were moderated by the instructor. On average, the instructor and tutors checked the discussion boards and responded once daily throughout the study periods.

The instructor for these 2 courses had a number of years’ experience in facilitating fully online courses. The tutors received training regarding the facilitation of group discussion.

An overview of the demographics of the two courses is presented in Table 3-1 for the Programming courses and Table 3-2 for the Introduction to IT courses.

### **3.5 Research Methodology**

The methods that we employed in order to carry out the research are discussed below.

#### **3.5.1 Action Research**

Action research has been defined as means or model for enacting local, action-oriented approaches of investigation and applying small-scale theorizing to specific problems in particular situations (Reason & Brabbury 2001; Reason 1994; Stringer 1999). Kemmis and McTaggart (1988) describe action research process as a spiral of activity: plan, act, observe and reflect. Other descriptions of action research suggest a varied grouping of activities, but the process they delineate is similar and typically spiral. Stringer's (1999) spiral is look, think and act. In fact, different researchers describe and as well as apply the same set of activities in action research but in different ways and sequences (Berg 2004).

#### **3.5.2 Grounded Theoretic Approach**

Grounded theoretic approach (Strauss & Corbin 1998) i.e. open, axial and selective coding (Neuman 2006; Strauss & Corbin 1990; Glaser & Strauss 1967) is an effective way to investigate qualitative data so that information relevant to the research can be extracted. The purpose of open coding is to identify the themes which emerge from the data. It is the process of identifying a set of themes or categories that appear to be relevant in order to describe and explain the phenomenon under investigation (Seidel & Recker 2009).

Following open coding, the next step is axial coding, where the aim is to assemble coding categories into larger conceptual groupings (Glaser & Strauss

1967). Each category can consist of a number of themes and sub-themes. This process is repeated until no additional categories are identified and all the data are analyzed.

The third and final coding step is selective coding. Again, the data are re-examined and the prior coding and grouping is revisited and verified or changed as required. A similar three stage data analysis technique was used by Vlachopoulos and Cowan (2010a, 2010b) while exploring the different styles and practice of e-moderation; and reports that this method is useful in gaining deep understanding of a phenomenon or a theme from raw data.

The grounded theory approach ensures that nascent theory is informed by the data; it is not preconceived or forced upon the data but rather emerges from it (Seidel & Recker 2009; Strauss & Corbin 1998). The advantages of grounded theory approach include its capacity for a detailed study of the micro issues of a larger reality within particular settings (Glaser & Strauss 1967). The result of this type of approach is that a theory emerges from the data. Strauss (1967, p.22) summarizes the grounded theoretic approach by terming it as a systematic analysis of documents, interview notes or field notes by coding and comparing the data that produced a well-constructed theory.

### **3.5.3 NVivo**

In order to carry out the open, axial and selective coding, we use a software package named NVivo. NVivo is a qualitative data analysis software package produced by QSR International (QSR International 2012). It has been designed for qualitative researchers working with very rich text-based and/or multimedia information, where deep levels of analysis on small or large volumes of data are required. NVivo was chosen because of its potential benefits such as coding can be made visible in the margins of documents so that the researcher can see, at a

glance, which codes have been used where and is possible to write memos about particular aspects of documents and link these to relevant pieces of text in different documents (Welsh 2002). The whole document of data can be loaded in the software and coding tree or hierarchy can be created and analysed.

### **3.6 Research Structure**

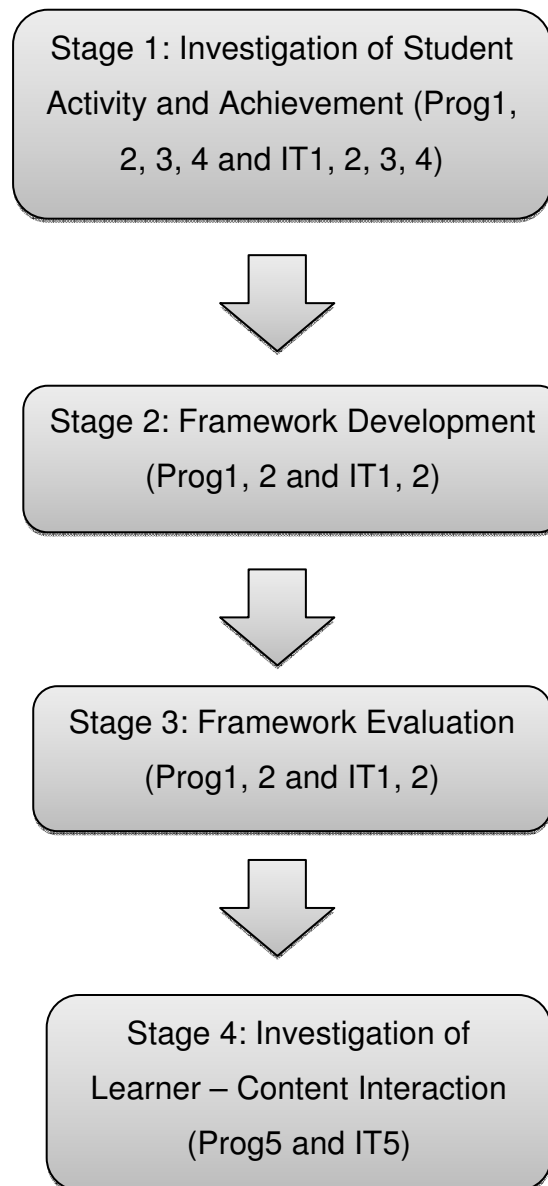
The overall research design structure is illustrated in Figure 3-1 and presented in the next four sub-sections of this chapter.

#### **3.6.1 Stage 1: Investigation of Student Activity and Achievement**

The objective of the first stage the research is to investigate the factors that affect student activity and achievement in fully online courses. It is important to analyse and find out the existing course management factors impacting student participation and achievement before developing the frameworks. To carry out our research in this stage, we apply concepts from action research method discussed in Section 3.5.1. The concepts from action research approach are chosen partly because the solution of the problem is not clear but complex (Avison, Myers & Nielsen 1999). The concepts also fit the complex, real world problem of interactions in fully online learning in computer science and IT courses.

Hence by following the concepts of action research, we investigate student activity and achievement in two phases. In Phase 1, we measure how active students are in online discussion forums and the correlation between this activity and the overall marks obtained in the subject, if there are any (Nandi et al. 2011). We investigate data from 2 courses i.e. Prog1 and IT1 in Phase 1. After the data

are analysed from Phase 1, we then identify several factors that may have an impact on participation and achievement of fully online students.



**Figure 3-1 Overall research design.**

In Phase 2, we analyse the effect of the changes made to course management as a result of Phase 1. Descriptions of all the changes that we have identified and summarized are presented in Table 3-1 for the programming courses and Table 3-2 for the IT courses. We then investigate the data collected over 4 study

periods where different changes were made by the instructors. We collected data from Blackboard, the University's Learning Management System throughout IT1, IT2, IT3, IT4, Prog1, Prog2, Prog3 and Prog4 starting from September 2009 until November 2010. We decided to include IT3, IT4, Prog3 and Prog4 as well along with IT2 and Prog2 as it would provide us with more recent data and hence updated information about the usage of online discussions. Analysis is carried out to investigate the impacts of the course management factors on the participation and achievement of the fully online students. A detailed description of the findings of our data analysis and discussion will be presented in Chapter 4.

### **3.6.2 Stage 2: Framework Development**

According to Yin (1994), a case study methodology should be employed to examine questions related to “how” and “why”, where the investigators have little or no possibility of controlling events and the study is on contemporary phenomena in a real-life context. The case study approach is chosen for this stage of our research. Using this method we investigate “how” related questions where we have no possibility of controlling events, our context being the real-life online interaction among students and instructors.

The purpose of this stage is to identify the key themes regarding student – student interaction and the instructor contribution. Based on the data analysis we intend to develop two frameworks for effective student – student interaction and instructor contribution. We analyse the discussion forum participation of the students and the instructors to identify the themes and sub-themes. In order to carry out this stage of the research, we selected four courses which are Prog1, Prog2, IT1 and IT2.



Course	Results			Study Level (%)		Age Level (%)			First time Online (%)	
	HD	DNS	Fail	UG	PG	20-30	30-40	< 20 and > 40	Yes	No
IT1	96	118	18	95	5	60	40	0	70	30
IT2	147	102	73	97	3	50	50	0	80	20
PROG1	131	120	60	95	5	70	30	0	80	20
PROG2	98	99	44	98	2	60	40	0	80	20

**Table 3-3 Background data for the students and their results in the courses over the two study periods.**

Table 3-3 provides a general overview of the background information of the students for Stage 2. It also shows the number of undergraduate (UG) and postgraduate (PG) students in the course along with the number of students who achieved a High Distinction (HD) (result of 80% or higher), those who failed in the courses and who did not continue the course and dropped out (DNS). Table 3-3 also shows that most of the students are undergraduate students within the age of 20 - 30 and using the fully online learning environment for the first time.

We analyze the discussion forum participations of the students within the learning management system, Blackboard. On average, there are 60-70 posts from students and 20-25 posts from the instructor and tutors in each week's group discussion forums and in each of the assignment threads in the IT courses. This number is around 30-40 for the students and 10-15 for the instructors in the programming courses. Participation in the group discussion forum was assessed by the instructor based on his experience at the end of the course. Students were not given any criteria for assessment beforehand, but it was mentioned that assessment would be based on the quality of posts and not quantity.

We collected data from two discussion forums from each of the courses over two study periods. One was an assignment discussion forum and the other was a general discussion forum on weekly topics from the course material. We decided to choose the “Assignment 1” and “Week 6” forums from the IT1 and 2 courses and “Assignment 1” and “Week 2” from Prog1 and 2 courses as these forums had high participation rate.

In IT1 and 2 courses, “Week 6” discussion was about learning networks and the Internet. In the Prog1 and 2 courses, “Week 2” discussion was about learning the initial concepts of programming using Alice programming language. Assignment 1 was about developing a basic website using HTML in IT1 and 2 and Assignment 1 was around writing a basic program using Alice in Prog1 and 2.

We attempt to uncover all the themes by analyzing the discussion forum posts through qualitative data analysis. These themes provide a clear representation regarding what the participants regard as quality and productive discussion between students and the instructors and how they actually participated in the forums. Small scale qualitative analysis is also performed to calculate the number of times each theme appeared in discussion.

We process qualitative data using grounded theoretic approach (Strauss & Corbin 1998) i.e. open, axial and selective coding (Neuman 2006; Strauss & Corbin 1990) so that information relevant to the research could be extracted. All the data from the discussion forum were loaded into NVivo (version 8) software for investigation through open, axial and selective coding.

The purpose of open coding is to identify the themes which have emerged within the discussion forums. We find around 45-50 themes by analyzing the data at the end of the open coding phase. Each separate concept in the data was labeled and similar ideas were grouped and labeled. Following open coding, the next step is axial coding, where the aim is to assemble coding categories into

larger conceptual groupings (Glaser & Strauss 1967). The two major categories emerge are student participation and instructor contribution. Each category consists of a number of themes and sub-themes. This process is repeated until no additional categories are identified and all the data are analyzed.

The third and final coding step is selective coding. Again, the data are re-examined and the prior coding and grouping is revisited and verified or changed as required. This set of themes is presented in the “findings” section. At the end of the data analysis the “student participation” category has around 14 sub categories and “instructor contribution” has around 12 sub categories. This categorization explains what types of posts are valued as quality participation by the students and instructors in these two introductory fully online courses.

Details of the findings of data analysis and the proposed frameworks for student – student and instructor contributions are presented in Chapter 5

### **3.6.3 Stage 3: Evaluation of Framework**

The purpose of this stage is to evaluate the two frameworks developed in Stage 2 of the research. We carried out surveys with the students to understand their concept about quality interaction.

We conducted surveys with the students from Prog1, Prog2, IT1 and IT2. The survey questionnaire (Appendix A) consisted of three parts:

- (1) Background information: These asked participants for some general background information.
- (2) Closed statements: These asked participants about their experience of the usage of the fully online environment, the mobility of the courses and the role of the instructors. These statements also included criteria from the framework

of Nandi, Chang and Balbo (2009). The intention was to investigate whether fully online students agree or disagree with a set of criteria derived through research into blended learning environments.

- (3) Open-ended questions: These questions provided the major source of data to investigate regarding what attributes the participants perceive for a discussion to be high in quality and beneficial to their learning.

Quality interaction influences learner satisfaction (Alavi & Dufner 2005) and learning outcome (LaPointe & Gunawardena 2004) and so it is important to recognize how students define this concept of quality interaction. Through qualitative data analysis, we attempt to uncover all the themes by analysing the survey responses. These themes provide a clear representation regarding what the participants consider to be quality and productive discussion between students and the instructors.

The open ended responses in the survey are processed using the grounded theoretic approach (Strauss & Corbin 1998) i.e. open, axial and selective coding (Neuman 2006; Strauss & Corbin 1990) as carried out in stage 2. All the responses were loaded into NVivo (version 9) software for investigation through open, axial and selective coding.

Open coding is carried out to analyse all the themes that students perceive as important criteria for quality interaction. We identify around 25-30 themes by analysing the data at the end of the open coding phase. Each separate concept in the data is labelled and similar ideas are grouped together and re-labelled. Following open coding, we conduct axial coding, where the aim is to assemble the coding categories into larger conceptual groupings (Glaser & Strauss 1967). At this stage, the two major categories which are looked at are student interaction and instructor contribution. These categories are made so that the two frameworks developed in Stage 2 can be evaluated. This process is repeated until no additional categories are identified and all the data have been analysed.

The third and final coding step is selective coding. Again, the data are re-examined and the prior coding and grouping is revisited and verified or changed as required. This set of emergent themes is presented in Chapter 6. At the end of the data analysis the “student participation” category has 11 sub categories and the “instructor contribution” has 8 categories. This categorization helps to explain what types of posts are valued as quality participation by the students and instructors in these two introductory fully online courses.

The themes and sub-themes identified from this stage are compared with the frameworks developed in Stage 2 and an evaluation of the frameworks is carried out. Depending on the evaluation, we modify the frameworks and details are presented in Chapter 6.

#### **3.6.4 Stage 4: Student – Content Interaction**

The purpose of this stage is to investigate student – content interaction. We carry out this stage of the research by conducting a survey with the students. As fully online courses provide a mostly learner-centred environment, the views of the students about the online content and content management strategies are investigated. The suggestions of the students on how effective student – content interaction can be ensured are analysed. Based on this analysis, specific guidelines are proposed to ensure proper interaction with the content.

This is mainly a qualitative study with data from 2 cohorts of students from Prog5 and IT5 collected over a study period. The questions regarding student – content interaction were not asked in the first 4 courses. Hence we collected data from IT5 and Prog5 courses which also provided us with more updated and recent data. We collected data through surveys throughout the study periods starting from June 2011 till August 2011.

The survey was conducted with the students from both the courses. The survey questionnaire (Appendix B) consisted of two parts:

- (1) Background information: These asked participants for some general information.
- (2) Open-ended questions: These questions provided the major source of data to investigate what factors affect student – content interaction. These questions asked the students about their views on the content distribution and management. Apart from questions asking about “what” factors, the emphasis was also on “why”. This provided the students with opportunity to identify the flaws in the current system as well as suggest the improvements that would benefit their interaction with content. As these fully online courses are highly learner-centered, the opinions of the students are very important to take into consideration. The survey also consisted of questions regarding which content areas students access and participate most, which medium of communication they prefer most, their choice for the type of books and the reasons behind these preferences.

Through qualitative data analysis of the survey responses, we attempt to uncover all the factors that affect student – content interaction. These themes provide a clear representation regarding what the participants consider to be essential factors for setting up effective content management strategies.

For data analysis, we follow grounded theoretic approach (Strauss & Corbin 1998) i.e. open, axial and selective coding (Neuman 2006; Strauss & Corbin 1990), the same technique used in Stage 2 and 3 to ensure consistency of analysis. All the responses are loaded into NVivo (version 9) software for investigation through open, axial and selective coding.

The purpose of open coding is to identify the themes which emerge through the responses of the students. We identify around 50 themes by analyzing the data at the end of the open coding phase. Following open coding, the next step is axial coding, where the aim is to assemble the coding categories into larger conceptual groupings (Glaser & Strauss 1967). Eight major categories emerge through data analysis with some categories consisting of sub-themes. This process is repeated until no additional categories are identified and all the data have been analyzed.

The third and final coding step is selective coding. Again, the data are re-examined and the prior coding and grouping was revisited and verified or changed as required. This set of emergent themes and sub-themes are presented in Chapter 7 which explains what factors need to be considered for effective student – content interaction in fully online courses.

### ***3.7 Rigour, Relevance and Credibility of our Research***

Benbasat and Zmud (1999) state that rigour, relevance and credibility are important criteria to ensure quality research outcome. Research is rigorous to certain extent if it follows acceptable research design practice and the methodology is transparent and explicit (Mays & Pope 1995). Although Barbour (2001) suggests that no research can be described as absolutely rigorous, our approach supported the rigour of these stages. Our choice for data collection and analysis at the four stages of research was guided and influenced by the prior research (Babbie 2004; Keen 1991; Strauss & Corbin 1998). The detailed analysis of data is provided in Chapters 4, 5, 6 and 7.

Relevancy of research has been defined as being of use to practitioners, where those practitioners may be based in industry, or education, or academic institutions. Benbasat and Zmud (1999) suggest that a key aspect of usefulness

or relevance of research is that it provides suggestions that can be followed or can stimulate further enquiry in the area under study. The research described in this thesis is relevant in the sense that it addresses an important issue in research and practitioner knowledge that relates to defining quality of interaction for fully online courses. By doing so, it examines the set of criteria to develop a framework to support interaction.

We use prolonged engagement, persistent observation, triangulation, and peer debriefing (Baran & Correia 2009) to ensure the credibility of the findings. The instructor of the courses is not a part of the investigation team which eliminate any chance of bias in analysis. One researcher analysed the data, categorized the themes for consistency and presented the findings to co-researchers through peer debriefing and discussion. Peer debriefing activity provides an external check on the inquiry process (Lincoln & Guba 1985). Inconsistencies and disagreement are discussed and managed through consensus reaching. A complete explanation of the courses and participants are presented above in previous sections in this chapter to ensure the transferability of the study. The data analysis enables the extraction of key and relevant information to the research and as a result, the research question is explored based on the results ascertained through these methods. Through this research we intend to propose design principles through which online participation of students and contribution of instructors can be developed in fully online computer science or IT courses.

### ***3.8 Boundaries of This Research***

One scope boundary of our research was it covers Australia based students primarily with only a few from outside Australia. All the students were enrolled in Open University Australia courses conducted via RMIT University and mostly from one geographic area (Australia and New Zealand). While there may be differences in interaction quality depending on culture, an initial understanding



such as we have developed within a single environment allows later research to compare and contrast any results more effectively. No information regarding the cultural background of the students was collected and analysed.

We also had different groups of students for each of the survey administrations. We were also not able to identify the activity of the students in the discussion forum who responded to the surveys. In addition we collected no information about external influences that might have impacted their participation and results and can be considered a limitation of our research. An analysis of such influences could more add value to the findings of our results.

One major scope boundary was that the procedure of data collection and analysis in our research design was completely student-centred. This decision was influenced by the fact that fully online system itself is considered as fully student-centred. Although we collected data from instructors via surveys, the number of responses was too small for a meaningful sample.

Another scope boundary of our final research stage to investigate student – content interaction was the inability to intervene and apply the set of identified criteria in the course. Although we identify critical design considerations for effective student – content interaction, the decision for actual application of these design criteria rests with the course administrators. As a result, an intervention to apply these criteria and investigate the resulting effects was not possible.

### **3.9 Summary**

This chapter has outlined our overall research design and methodology, including major influences on research design, the research designs itself, how the issues of rigour, relevance and credibility of the research was addressed, and the boundaries of this research . The conduct of the four research stages (Figure 3-

1) will be described in the next four chapters respectively, with the next chapter, Chapter 4, describing the first stage of the research, investigating the student activity and achievement.

# **Chapter 4 - Investigation of Student Activity and Achievement**

In this chapter we address the following research question:

*What are the important factors that affect student activity in fully online courses?*

We investigate this research question in two phases. In the first phase, we measure how active students are in online discussion forums and the correlation between this activity and the overall marks obtained in the subject (Nandi et al. 2011). In the second phase we investigate what factors of the online environment or course management impact on student participation and achievement.

## **4.1 Phase 1 – Analysis of Initial Activity and Achievement**

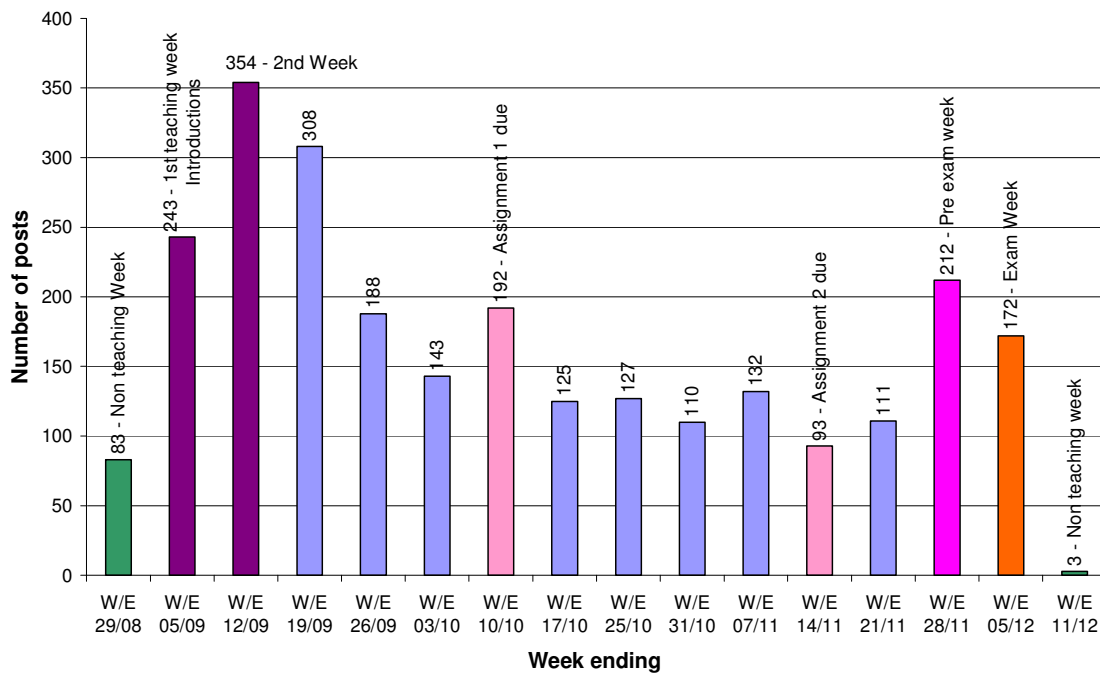
As mentioned above, in the first phase, we measure how active students are in online discussion forums and the correlations between this activity and the overall marks obtained in the subject, if there are any. For this phase we take the data from Prog1 and IT1 during the study period September 2009 – November 2009.

To determine the distribution of student activity we record the number of accesses and posts by the students throughout the study period. At the end of the study period, assignment and final examination results for each student are recorded. Using these assessment results we investigate if there is a correlation between the level of student activity in discussion forums and the grades they achieved.

### 4.1.1 Data Analysis and Findings

The IT1 course had 299 students enrolled whereas there are 346 enrolments in the Prog1 course. The students are located in many parts of Australia and also different parts of the world while studying the courses. The age of the students ranges in between 20 to 70 which represent diversity in maturity and motivations of the students.

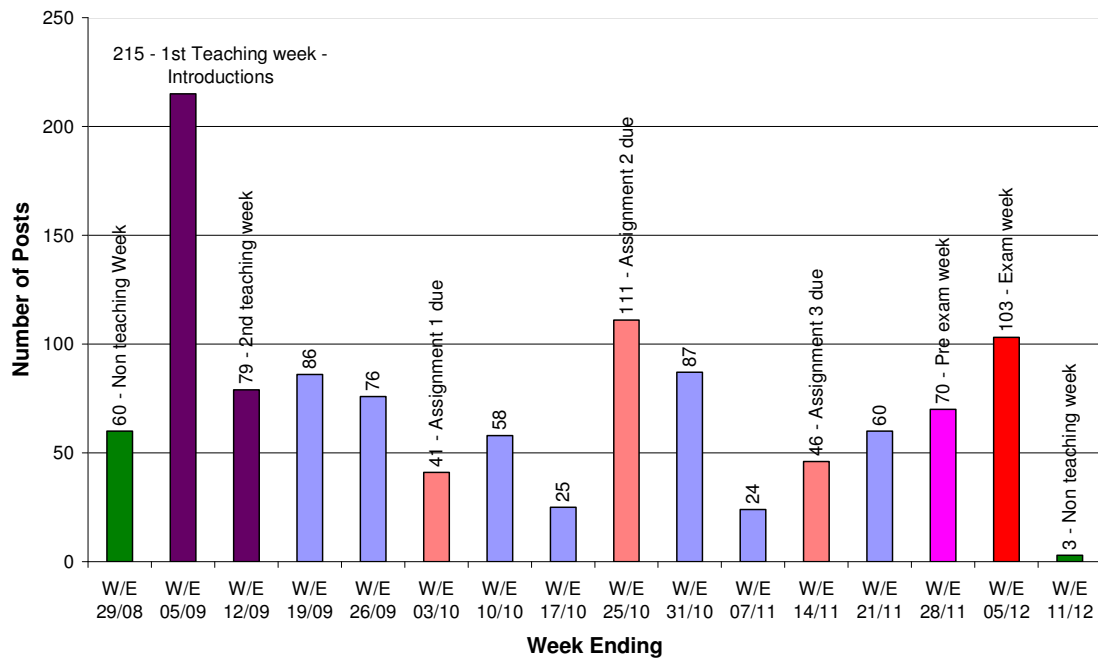
The IT1 course has two extra tutors apart from the instructor and the discussion board participation in the course are assessed and with 10% of the total mark allocated for participation. The Prog1 course is conducted by the instructor alone with no tutor support and the discussion participation is not assessed.



**Figure 4-1 Posts by week for IT1 course.**

Figure 4-1 provides a broad-spectrum overview of the number of posts each week by the students in the IT1 course. It indicates that there are a high number of posts by students during the first couple of teaching weeks where students

may have tried to become familiar with the course details. The number of posts gradually decreases after the initial teaching weeks and again increases during weeks when assignments and examinations are due.

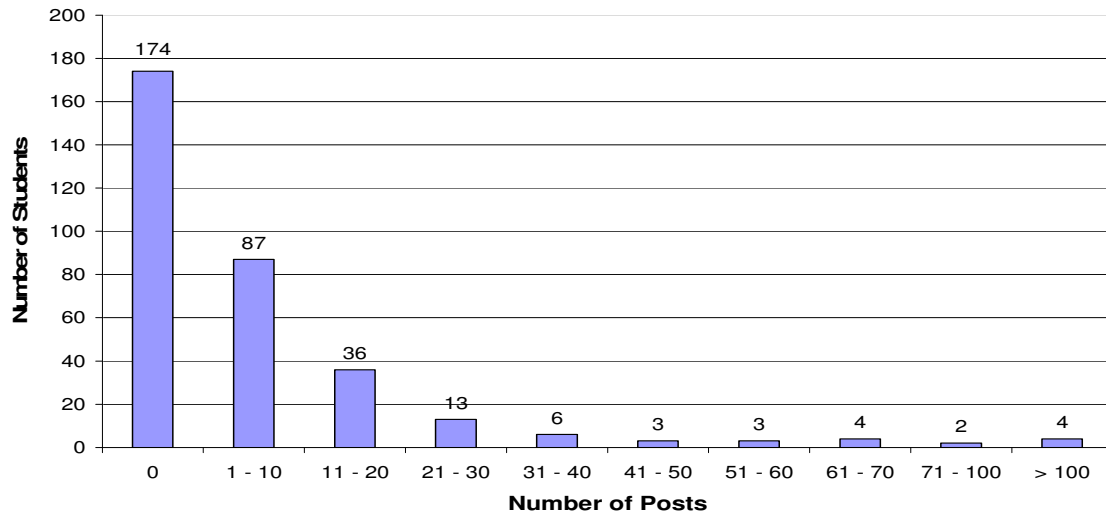


**Figure 4-2 Posts by week for Prog1 course.**

Figure 4-2 provides an overview for the number of posts each week by the students in the Prog1 course. It initially provides a similar scenario like Figure 1 where there are soaring numbers of posts in the first couple of weeks. However the number of posts gradually declines and is quite low before the first assignment is due, unlike the trend in the IT1 course. The trend remains the same throughout the study period as assignment weeks failed to attract high number of posts as seen in the IT1 course.

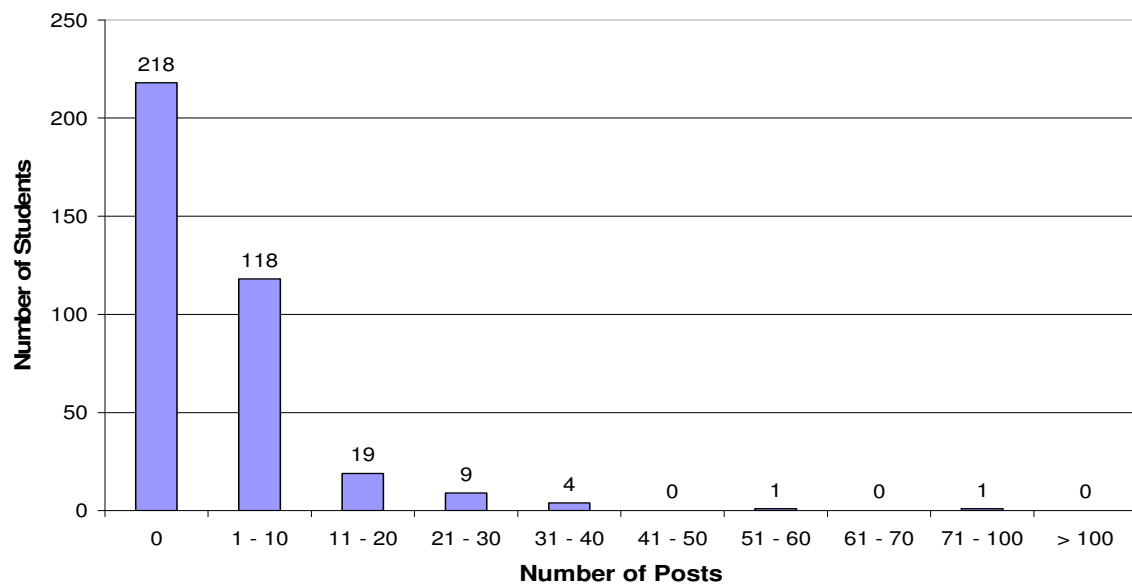
Figures 4-3 and 4-4 provide the number of posts by the students in the two courses respectively. Both the figures reveal there are a high number of students with zero posts (174 in IT1 and 218 in Prog1). These students do not post at all

during the study period. Although the graphs are prepared with different distributions of number of students, the weekly trend of posts is very similar.



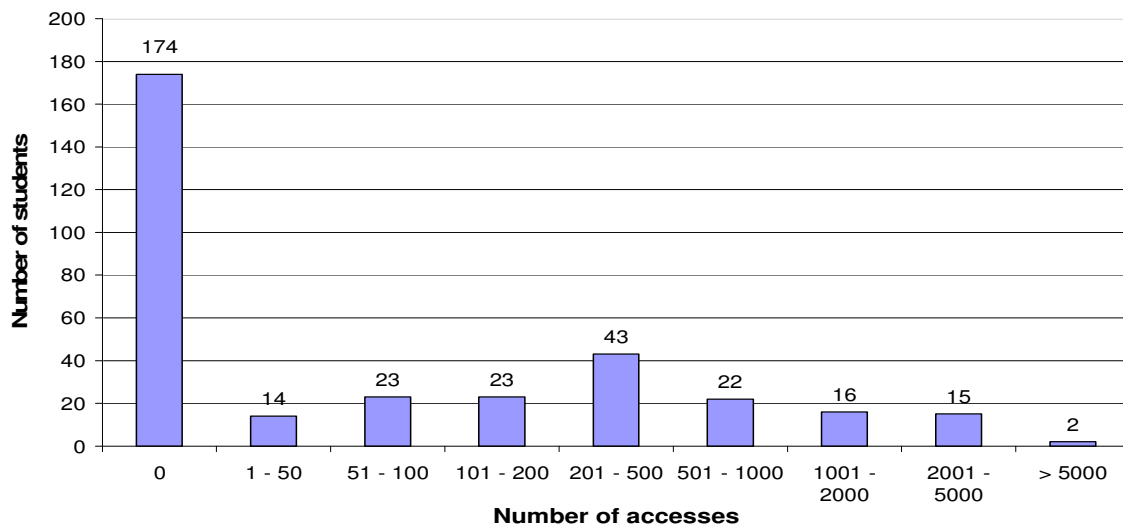
**Figure 4-3 Posts by students for IT1 course.**

When ascertaining the activity of the students in discussion boards, using only the actual number of posts may not provide the overall picture.



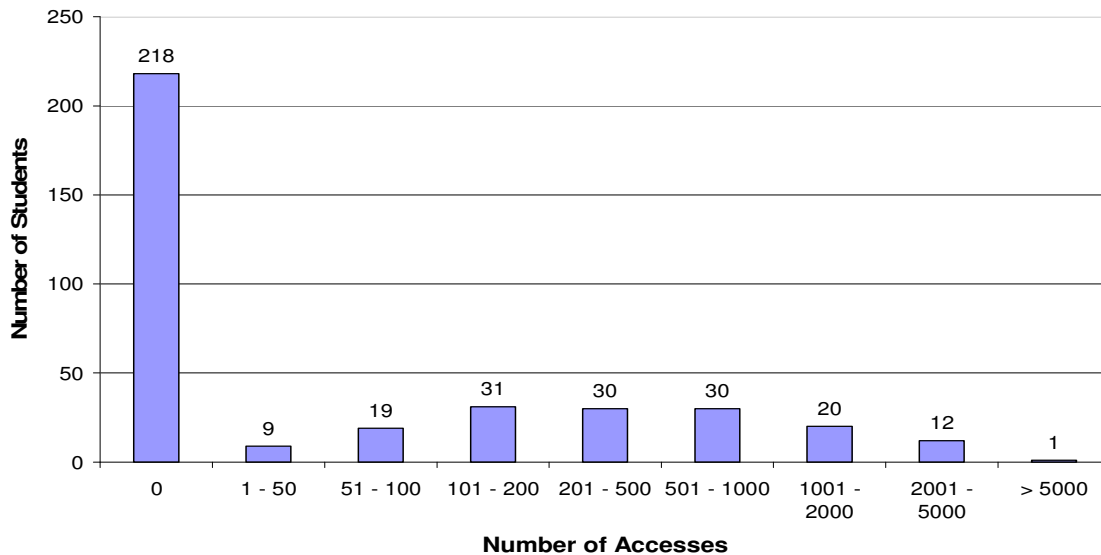
**Figure 4-4 Posts by students for Prog1 course.**

As well as students that who post in the forum, there may also be a significant number of “lurkers” present (Salmon 2003; Guzdial & Carroll 2002) in both the courses. Hence we have graphed the number of accesses by students in discussion forums against the number of students in Figures 4-5 and 4-6 for IT1 and Prog1 courses respectively.



**Figure 4-5 Accesses by students for IT1 course.**

Comparing Figures 4-5 and 4-6 indicates that there is a similarity between the trends of student accesses in both subjects. Also there is a high number of students who do not access the discussion board. Not accessing and not posting might be a bit surprising for the IT1 course as the participation in the discussion board is assessed and ten marks are allocated for posting on the discussion board.



**Figure 4-6 Accesses by students for Prog1 course.**

Comparing the posts and access data in the same course reveals a coincidence. Almost 58% ( $174/299 \times 100$ ) of students do not access and post in IT1. This rate of “0” accessing and posting is around 63% ( $218/346 \times 100$ ) in the Prog1 course. Consequently only around 40% of the total students in both the subjects access and post the online discussion forum. Further investigating the data closely demonstrates that students who accessed at least once also post in the discussion forum.

Figure 4-7 and 4-8 provide a general overview of the average number of student postings in the discussion board against their performance in each of the assessments in the study period. This allows us to investigate if there is a trend between the level of activity in online forums and the grades students achieve in each course. In general, most of the students with higher number of posts achieve Distinction or High Distinction in the assignments and final assessment. The grades of High Distinction (HD) refers to marks which are in between 80-100, whereas Distinction (DI) refers to 70-79, Credit refers to 60-69, Pass (PA) refers to 50-59 and Fail refers to the of 0-49.



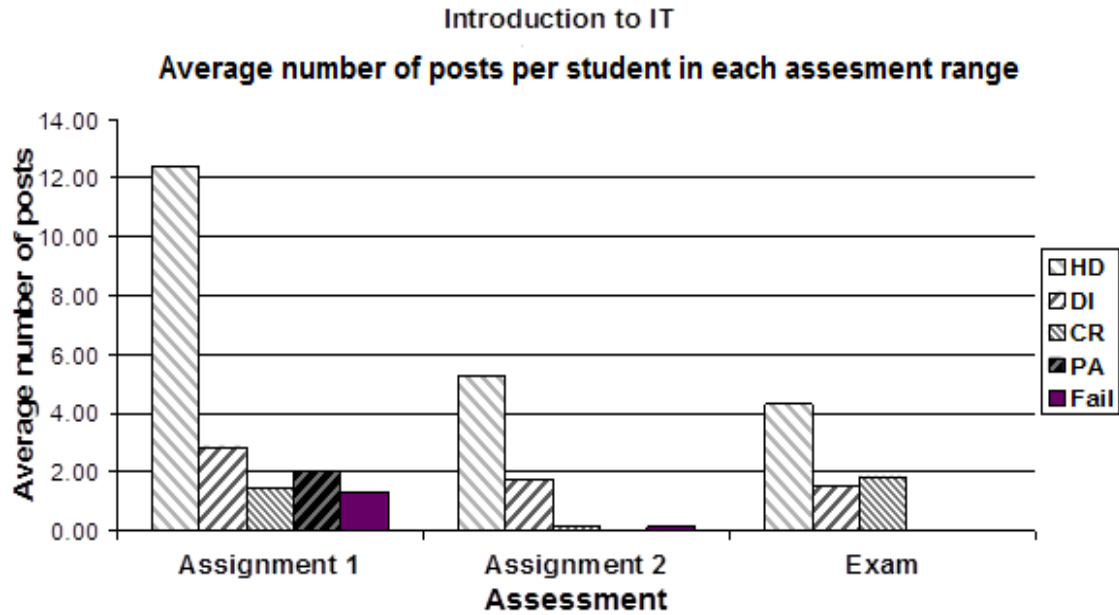


Figure 4-7 Grades achieved for IT1 course.

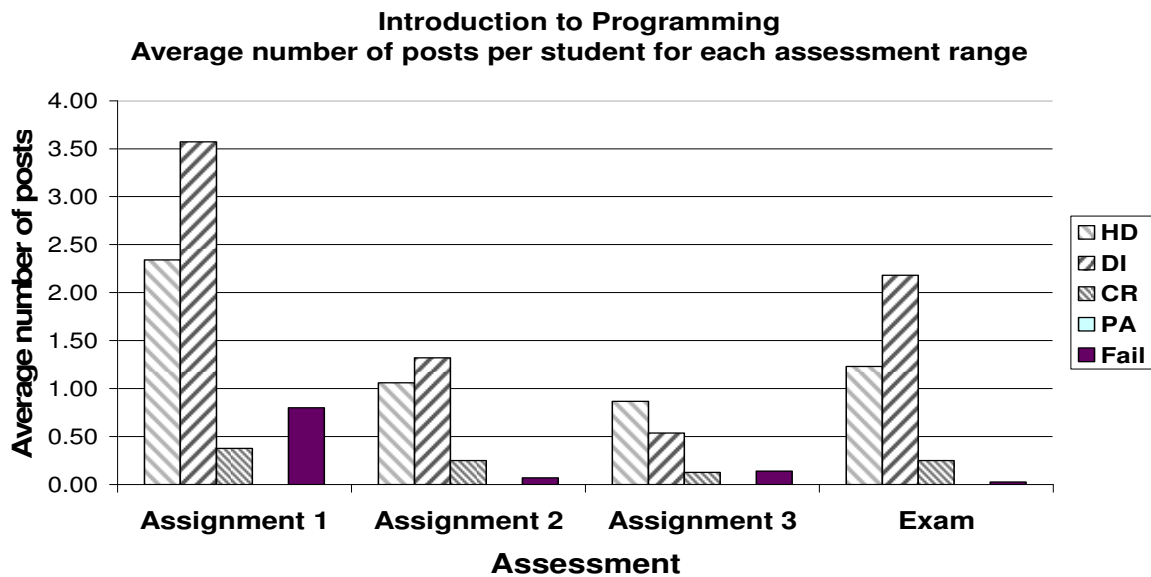


Figure 4-8 Grades achieved for Prog1 course.

There is a trend as most of the students who post only a few times either fail or just pass the course. This trend points to the fact that high achieving students participate in the online discussion forum more actively than other students.

#### **4.1.2 Discussion**

The data analysis and findings section has provided a general overview of the activity of the students in the two online courses. It also shows the number of students posting and accessing the forums over the study period. There are differences in the number of accesses and posts between the two courses and we consider various possibilities below, in terms of the content, the students themselves, the instructors and assessment.

##### **a) Impact of Content**

There is a difference in the overall number of posts by students throughout the semester in the two courses which we now consider. Although the Prog1 course has more enrolments (346) than the IT1 course (299), the overall rate of posting is higher in the IT1 course with around 41% compared with around 36% in the Prog1 course. This disparity could be explained by the dissimilarity in the content of the courses and the assessment carried out for participating.

The content for the Prog1 course is more prescriptive, as the course content is algorithmic and more narrowly focused and the opportunity for direct discussion and asking questions is limited. It is noticeable from observation that often a single solution by a student to a problem raised by another student or the instructor has ended the discussion at that point. The same situation applies to assignments as well. Once the solution is obtained, there is very little discussion to follow which may explain the reason for the generally low number of posts during the weeks when assignments are due.

Conversely, the IT1 course covers basic topics from general information technology with a vast area from both hardware and software. Often there is a lot to discuss about these topics from different angles. While discussing online, students point towards examples and real world situations from the past and current use of information technology in their personal and work life which broadened the discussion. This causes an upsurge in the number of posts. The identical situation applies for assignment weeks also where students discuss different solutions for the problems in the assignments causing a sharp rise in the number of posts. This situation points towards the fact that the content of the course has a bearing on the overall number of posts and direction of discussion. In a course like programming, it is often difficult for instructors or tutors also to extend discussions to attract more participation from students.

#### b) Diversity of Students

The diversity in participation can be defined by the research carried out by Sheard, Ramakrishna and Miller (2003) who pointed out that the background, maturity and motivations of learners have an impact on the online participation. As mentioned previously, students from different degrees e.g. Bachelor of Technology, Business IT, Indigenous Studies and Accountancy are all enrolled in the IT1 course. Many of them are not pursuing studies dominated by Information Technology. Hence those students need to participate more in the discussion forum to become familiar with the basic IT- related topics taught in the course.

The Prog1 course has students from the Bachelor of Technology and Master of Technology degree. Individually there might have been some diversity in the area of previous study or experience in programming; however they all are pursuing the same degree which is typically technology or programming. As a result they are more accustomed to handle the concepts of the Prog1 course and needed less attention and interaction with others.

### c) Difference in Tutor Support

As mentioned previously, the Introductory IT course has tutor support which is not the case in the introductory Programming course. Hence there are more tutors to answer questions and provide feedback which results in higher levels of participation in terms of number. This is one of the factors that Gerbic (2006) and Weaver (2005) identified as motivators of online participation of learners. This phenomenon explains that although online learning is more learner-centred, there is still the typical traditional instructor dependency. The more feedback students get from the instructors, the more they interact with the instructors and other students and are inspired by the presence of the instructors.

### d) Impact of Assessment

Research suggests that the strongest motivator for participation is to add some form of incentive as learners generally perceive that what is valued is what is assessed (Burkett, Leard & Spector 2004; Laurillard 2002; Leh 2002; Ramsden 2003; Sheard, Ramakrishna & Miller 2003; Seo 2007). The phenomenon of “lurkers” is most evident in online discussion forums where participation and engagement is not compulsory (Sheard et al. 2003; Sheard, Ramakrishna & Miller 2003).

Participation in the discussion forum in the IT1 course is mandatory as it is assessed and worth 10% of the final mark. This is one probable reason for the higher number of posts. Students have to post to get the marks and so it is highly valued by the students. The lower rate of participation in the Prog1 course can be explained by the fact that the forum participation is not assessed and students only post when in need of some assistance in solving problems.

#### e) Level of Activity and Achievement

It is important to ascertain the trend between activity and achievement to decide whether or not the online learning environment is totally student-centred and whether this isolated environment provides a barrier in achieving good results in online courses. We find that there is a trend between student activity in online discussion forums and the grades they achieved in each assessment. This is clearly evident from Figures 4-7 and 4-8. All the assessment marks of high achieving students are quite consistent with their participation throughout the semester. Generally the number of posts drops as the study period progresses, but the trend remains the same. The students who post more get higher marks in each assignment and in the exam than others, with this trend being same for both the courses. However, looking at this trend, it cannot be concluded that active participation is the only reason behind higher marks in assessments. There may be other factors that may influence the marks of the students and will be further investigated in future research.

#### **4.1.3 Lessons Learned**

Several lessons are learned from this research regarding the general behaviour of the online students and its impact.

##### a) Managing the Content Sequentially

The way course content is managed has an impact on how students participate in the discussion board. For example, if all the assignments are released during the first weeks of the course, then most of the students may start discussing all the assignments well before the due date of the first assignment. One of the reasons for that can be a “scare” factor regarding the assignments; this factor works in the minds of the students, being online and isolated makes this factor

more prominent. They start to consider the assignments as a hurdle and attempt to complete them as soon as possible. In this way, the focus of the students will be on the assignments rather than learning the basic concepts of the subjects. For these courses, all the assignments were released together at the beginning of the study period and this could explain why a lot of postings occur during the first few weeks and once all the assignment problems are clarified, the participation rate decreases. As a result of our study and observation, we believe that it is better to release the assignments periodically. By releasing the assignments periodically, the focus of the students can be diverted towards learning the subject matter sequentially which can provide them with a strong background on the subject material.

#### b) Managing Expectations

Managing expectations is another lesson that we learned from this phase. This expectation can be of two types: the expectations of the instructors and the expectations of the students. As we discussed earlier, the expectations of the instructors on how the students participate online depends on the content of the subject. In a course like IT1, where there is a vast opportunity for discussion, the expectation can be around 5-6 posts per week by the students. This number can be a bit too high for courses like Prog1 where there might be fewer prospects for the discussion to broaden.

From the above discussion we can see that the rate of “lurking” could be different for various subjects depending on the number of possibilities to answer, time of posting and release of content. In this research, we find there are no students who access but do not post over the study period. However there are students who access more, but post less, at different times, as shown in Figures 4-3, 4-4, 4-5 and 4-6. In a course like Prog1, there might be lot of “lurkers”, because the solution of a problem might already be there and lot of students might just view it

and not post. Hence the expected participation needs to vary depending on the content of the subject.

The expectations of the students are another aspect to consider. There is a tendency that students want the instructors only to answer their questions and get regular feedback. These factors might have been a reason for higher number of posts in the IT1 course than the Prog1 course. However instructors do need to consider their way of providing feedback and responses to the students' questions. This role of the instructor contributes towards the ultimate learning i.e. deep learning or surface learning.

#### c) Role of the Instructor

The role of the instructor is one aspect that needs to be taken into consideration while looking at the participation of the students. The way instructors moderate discussion forums has an impact on how the students participate. The type of moderation has a major impact on the direction and number of student participation. If the instructor directly answers the questions from the students, then the discussion ends there on the spot. Broadening discussions through hints, clues and directions consistently increases student participation.

#### d) Preference of Students

Students prefer to build a learning community early on in first few weeks. They introduce themselves and sometimes post their personal email addresses so that they can chat about the subject matter informally. Research shows that strong sense of community not only increases persistence of students in online programmes, but also enhances information flow, learning support, group commitment, collaboration, and learning satisfaction (Dede 1996; Wellman 1999). Hence students need to be encouraged to follow this practice of building online communities which ultimately leads to effective collaborative learning.

The preference of the students regarding the use of tools for online participation can have an impact on their posting online. This fact came up from close observation of the course that some students may prefer to use direct synchronous chat or audio tools to ask questions of the instructor and get an instant answer rather than posting on the discussion board and waiting for someone to answer. On the contrary, most students prefer to use the asynchronous discussion board where they can post questions and comments anonymously. Hence student preferences need to be taken into consideration while investigating online activity and participation.

This phase of the research has provided a general overview of the activity of students in the online discussion forums in two introductory courses in a fully online learning environment. As mentioned above, the aim of this stage was to investigate the trend of activity of students in these fully online courses and find out if there is a correlation between activity and grades achieved or not. Hence the major focus of this paper was to present the “big picture” showing the general activity of students in online forums.

The results of our data analysis show a high percentage of students do not access the discussion forums or post at all throughout the semester. However the results also show that it is essential to participate consistently to achieve a high grade. As we have seen from this stage, there are several underlying factors that contribute towards students’ active participation online.

The key lessons learned from this phase are that managing the course content and expectations have a large impact on how students participate on online discussion forums. This research has presented the expected behaviour of fully online students in discussion forums. The type of moderations carried out by the instructors and the preference of the students also shape the online discussion.



We carried these findings into the next phase where several changes were made to the course management. The decision to make these changes was influenced by the findings from the research done in Phase 1.

## ***4.2 Phase 2 – Investigation of the Factors That Impact Participation***

In Phase 2, we investigate the factors of the online course management that have an impact on student participation and achievement. We perform a quantitative data analysis in order to identify what factors affect the participation of the fully online students and whether these factors contribute towards their results or not. In this longitudinal study, data from 8 cohorts of students (IT1, IT2, IT3, IT4, Prog1, Prog2, Prog3 and Prog4) were collected over 4 study periods. Data was collected from Blackboard throughout 4 study periods starting from September 2009 till November 2010. As mentioned in Table 3-1 and 3-2, a number of changes were made regarding how the courses were managed in the 4 study periods.

To determine the factors that impact the student activity and achievement, the number of times students post in the discussion forums throughout the study period is recorded. We graph the number of posts against study weeks to analyse the trend of participation. We also analyse the student posting rates in each of the forums to investigate the distribution of participation. At the end of the study period, assignment and final examination results for each student are recorded. Using these assessment results we investigate whether the alterations in the course management have actually affected the student participation online or not and whether it has any impact on the results or not.

### 4.2.1 Data Analysis and Findings

From Table 3-1, it can be noted that the pass rate over the 4 study periods for the programming courses ranges in between 46.43% - 52.86%. The highest pass rate was achieved in Prog2 with 52.86%. The lowest pass rate in the intro to programming course is achieved in Prog4 with 46.43%. Prog4 has the lowest Student-Instructor (+Tutor) ratio but no marks are assigned for group discussion.

From Table 3-2, we see that the pass rate over the 4 study period for the IT courses ranges in between 48.75% - 57.64%. The highest pass rate is achieved in IT2 with 57.64%. The lowest pass rate is in IT3 with 48.75% where it also has the lowest student-Instructor (+Tutor) ratio of only 40:1.

#### a) Participation Overview

Figure 4-9 provides a broad-spectrum overview of the average number posts per student each week in the programming courses over the 4 study periods. It indicates that most posts occur for Prog2 and Prog3 cohorts for which the group discussion is assessed. Weeks 8 and 11 in Prog2 have more than the average number of student posts than other weeks. Normally during weeks 7 and 8, the course content shifts from Alice to Java and Assignment 3 is released. This may be one of the reasons for this high participation where students ask and respond to questions regarding Assignment 3. Again week 11 is the deadline for the Assignment 3 submission which also appears to trigger a lot of discussion. These two trends are evident from observation of forum posts. Apart from weeks 8 and 11, participation is generally consistent throughout the study periods.

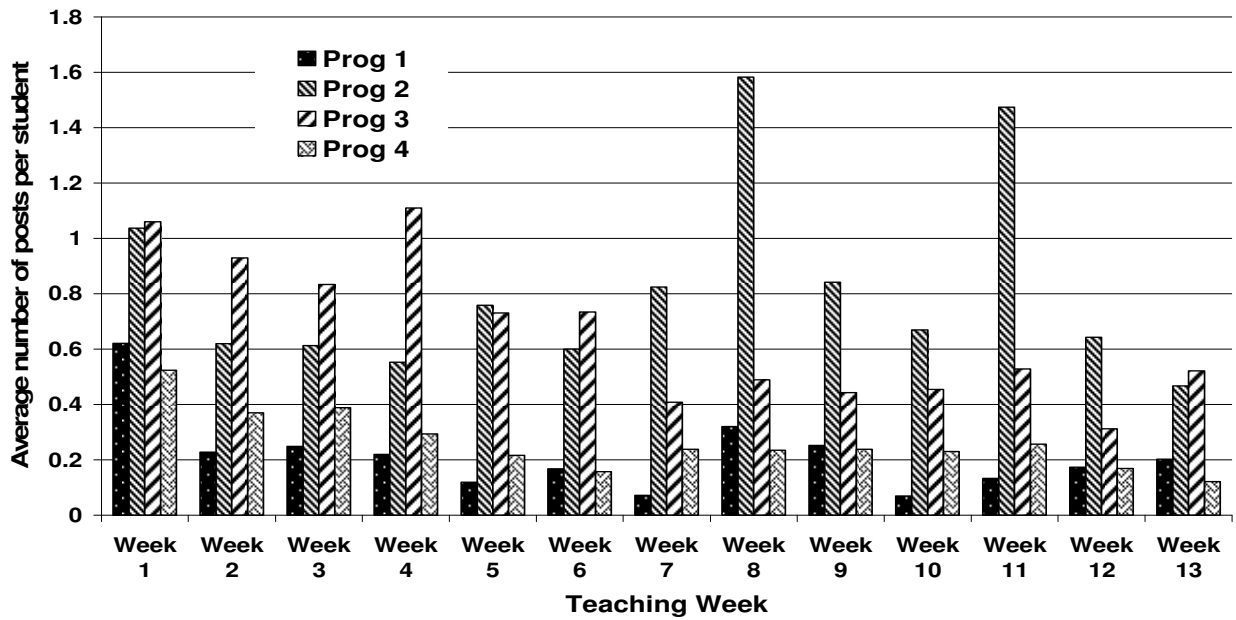


Figure 4-9 Posts by week (Prog1, 2, 3, 4).

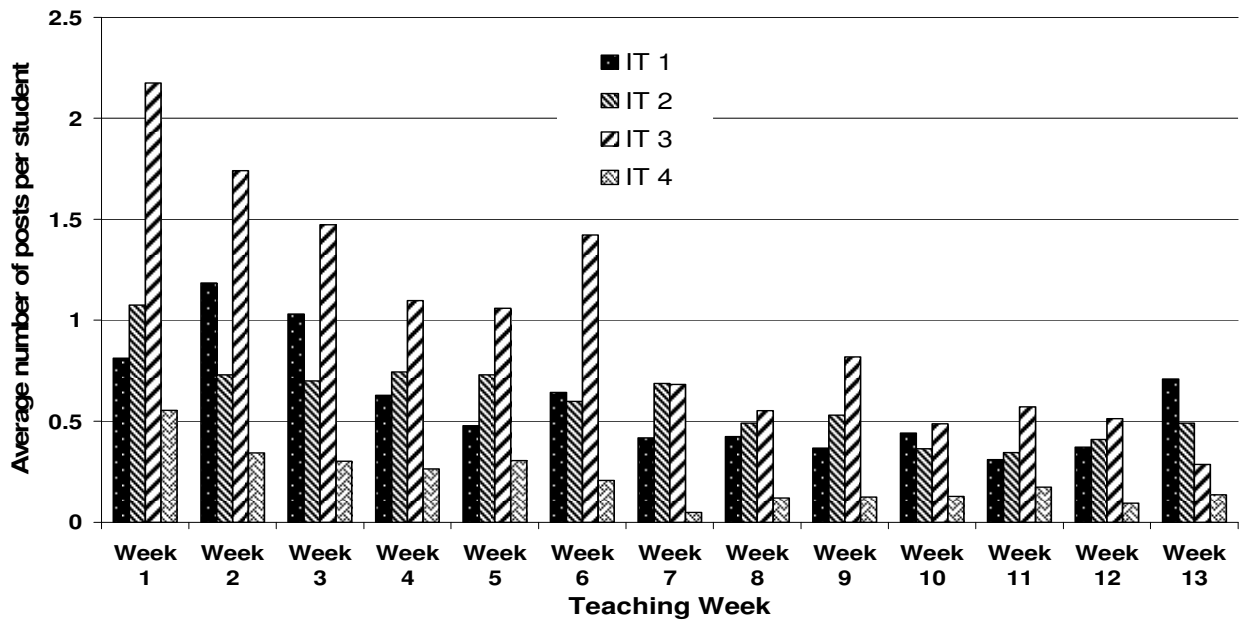


Figure 4-10 Posts by week (IT1, 2, 3, 4).

Figure 4-10 provides an overview for the average number of posts per student each week in the introduction to IT courses over the 4 study periods. In general, IT1, IT2 and IT3 see more posts throughout than IT4. Group participation is

assessed in those periods for IT1, IT2 and IT3 and marks are assigned which may be reason for high participation.

The noticeable issue is that number of posts in IT4 is very low throughout the study period which may be the result of removing assessment marks for participation. The number of posts decreases around week 7 for all the study periods and remains the same afterwards.

#### b) Posts by Forums

Figures 4-11 and 4-12 provide the percentages of students that posted in the programming and IT courses respectively. Both the figures show that most of the students actually post in the “Welcome and Introduction” forum where they try to build a community of learners by “virtually” meeting each other.

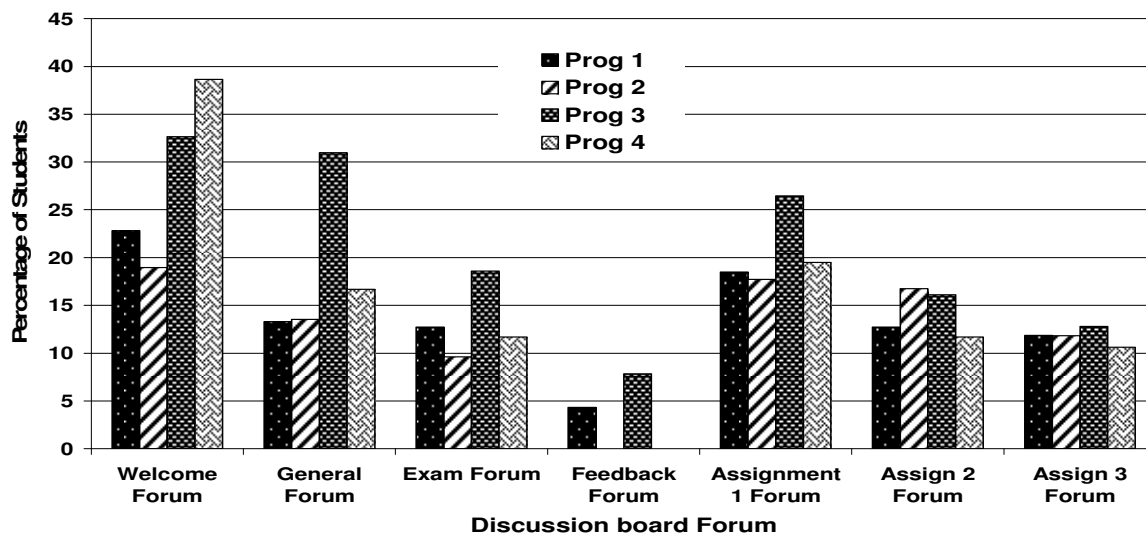
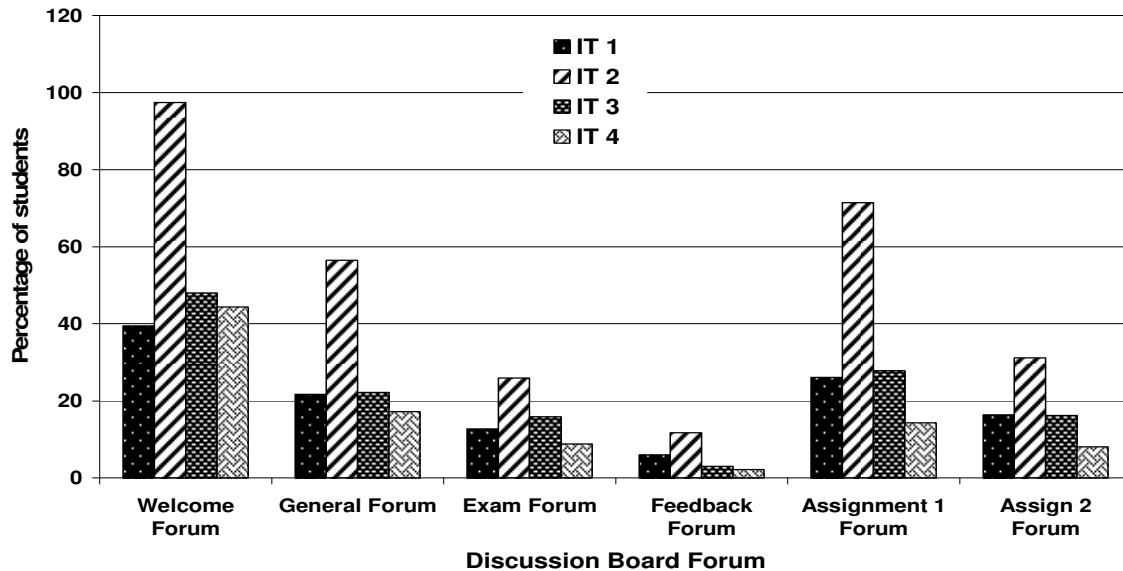


Figure 4-11 Percentages of students posting in different forums (Prog1, 2, 3, 4).

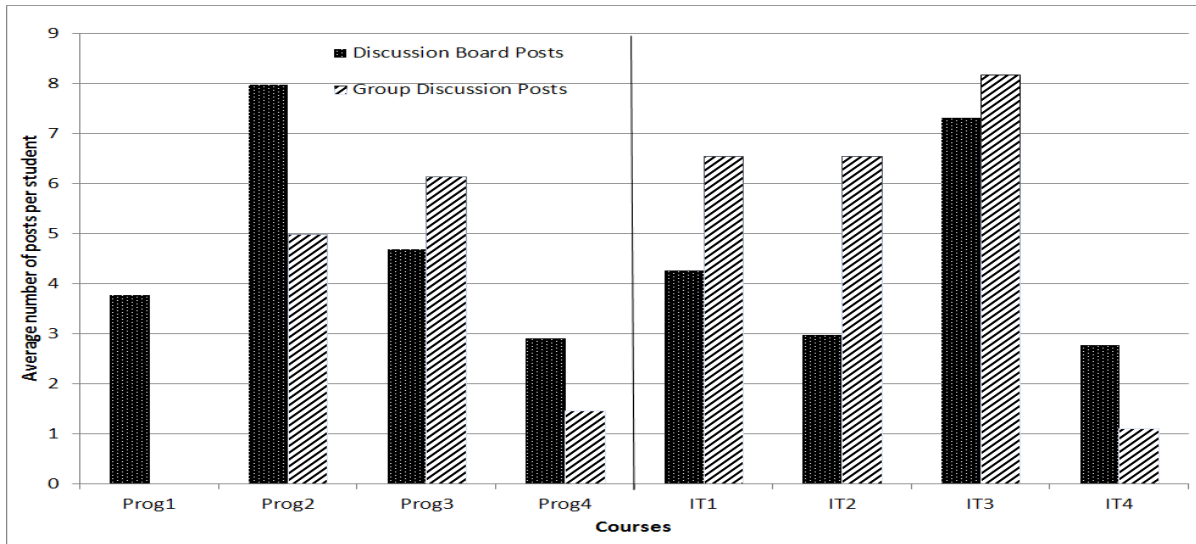
The second most populated forums are the Assignment 1 and General Forum threads. It has been noticeable that most of the online students employ a goal-based learning approach where they start to complete the assignments from the very first week and try to study course material that is relevant to the

assignments. This approach makes the Assignment 1 forum more populated than others.



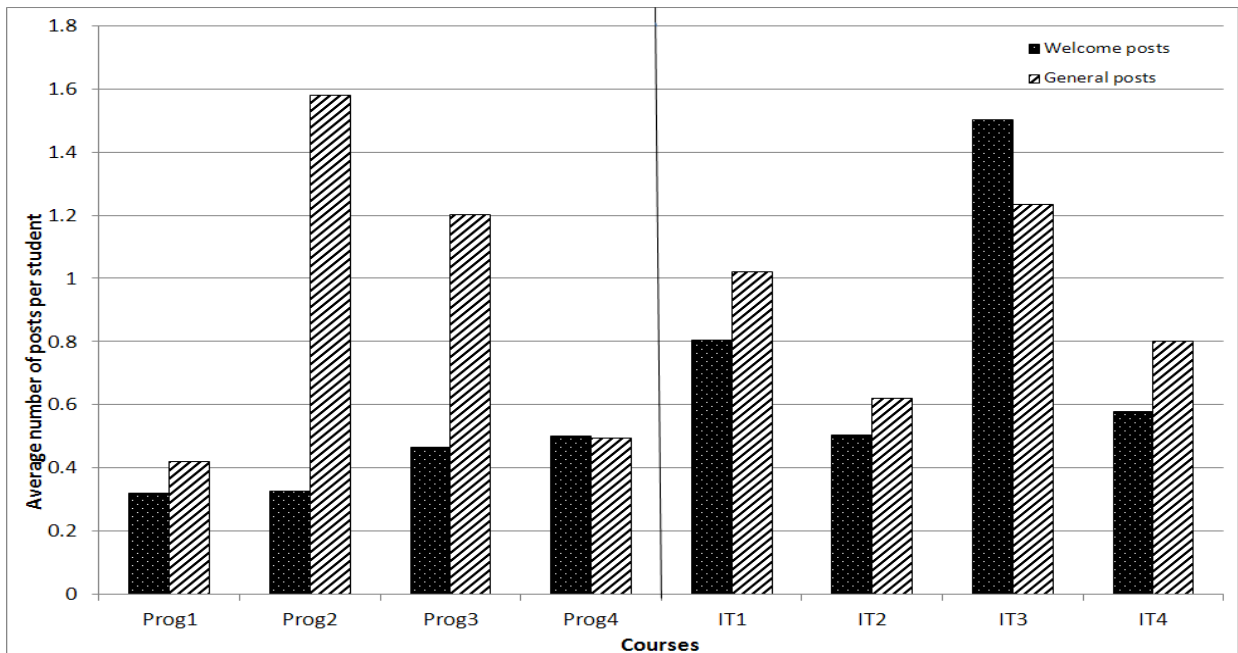
**Figure 4-12 Percentages of students posting in different forums (IT1, 2, 3, 4).**

In general, the number of students that post in the assignment forums ranges in between 10-20%. However this number is around 70% for assignment 1 in IT2 which is high compared to other assignments throughout the study periods. All the assignments s are released altogether in the first week in IT2 and it is noticeable from observation that, students post about both the assignments in the Assignment 1 thread right after the assignment specifications are released. As a result some confusion is also created.



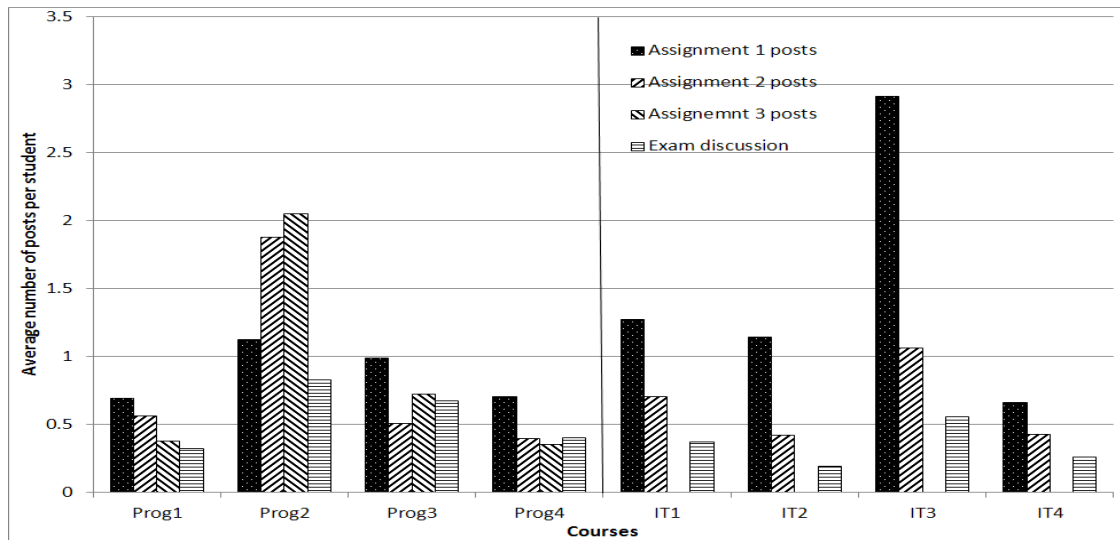
**Figure 4-13 Average number of posts in the main and group discussion forum.**

Figure 4-13 represents the average number of posts per student in the main discussion board and the group discussion board. In Prog1, the instructor did not have tutor support available and so there is no Group Discussion thread. Hence, all the weekly discussions take place in the Main Discussion board. The average number of Group Discussion posts is normally higher in both the courses apart from Prog2. This phenomenon can be explained by the fact that participation in Group Discussion board is assessed over these periods. The average number of posts decreases and the number of Group Discussion posts are lower than the number in the main discussions in both Prog4 and IT4 when the participation marks are withdrawn. The number of main discussion posts in Figure 4-13 includes the posts in “Welcome and Introduction”, “General Discussion”, “Assignment”, “Exam” and “Feedback” which has been broken down in Figures 4-14 and 4-15.



**Figure 4-14 Average numbers of posts in the “welcome” and “general” discussion forum**

Figure 4-14 shows that the average number of “General” posts per student is consistently higher than the “Welcome” posts. It indicates that students have issues with uncertainty about the programming language to use, right versions and installation issues and using the language to build programs. The number of “General” posts is also higher in the IT course which can be explained by the fact that students in this course come from different non-IT courses and has issues navigating through the learning management system. We observe this phenomenon from the students by looking at the forum posts where they frequently request technical assistance.



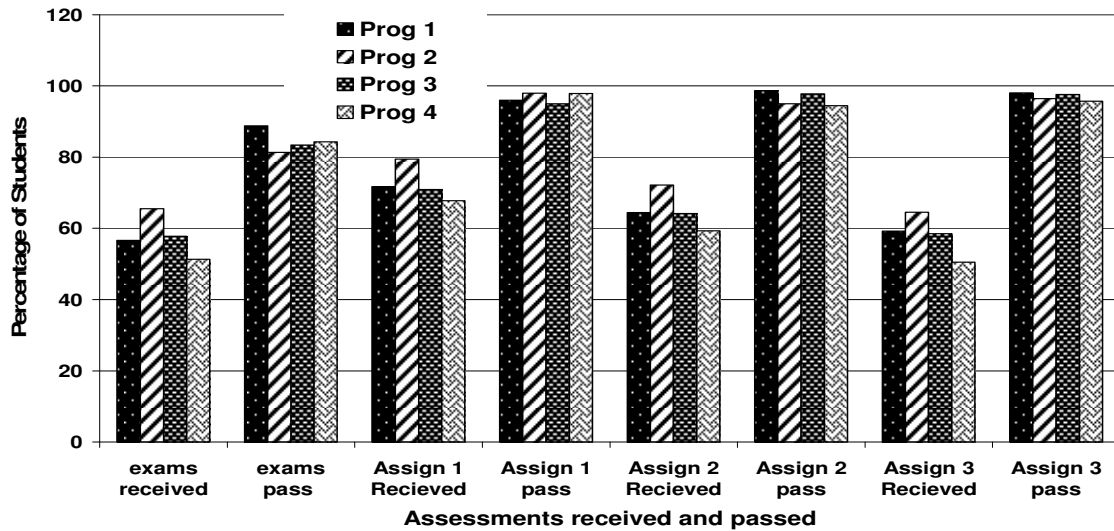
**Figure 4-15 Number of posts in the “assignment” and “exam” discussion forum.**

Figure 4-15 shows the average number of posts per student in the Assignment and Exam threads separately. In all the study periods apart from the Prog2, “Assignment 1” thread sees more posts than other assessments. It indicates that initially students may struggle to become accustomed with the course material and this eases overtime. However in Prog2, the number of posts gradually increases. If we compare this phenomenon with “Week 8” in Figure 4-9, we observe that some students find it difficult to switch to Java from Alice and execute the assignment using Java. Alternatively, some students enjoy programming with a “commercial programming language” i.e. Java and become more interested and involved in studying.

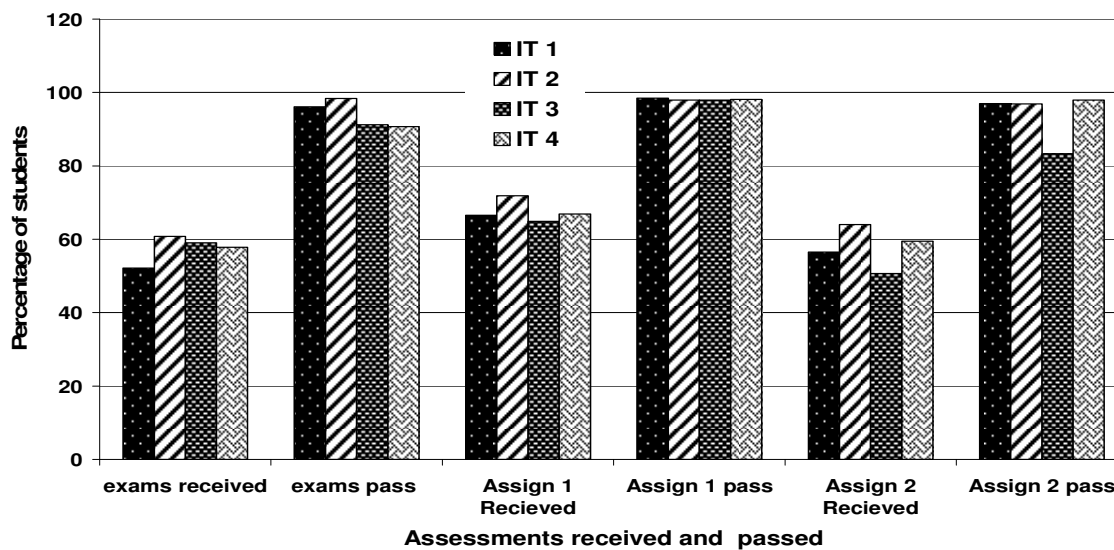
#### c) Assessment Components Received and Passed

Student satisfaction and dropout rates are the key determinant factors for the success of any course (Levy 2004; Piccoli, Ahmad & Ives 2001). More than 50% students drop out of the online IT/Programming courses compared with 10% in standard on-campus courses in IT training centres (Hannum, Irvin, Lei & Farmer, 2008; Zielinski, 2000).





**Figure 4-16 Percentages of students who completed the assignments and exams and passed (Prog1, 2, 3, 4).**

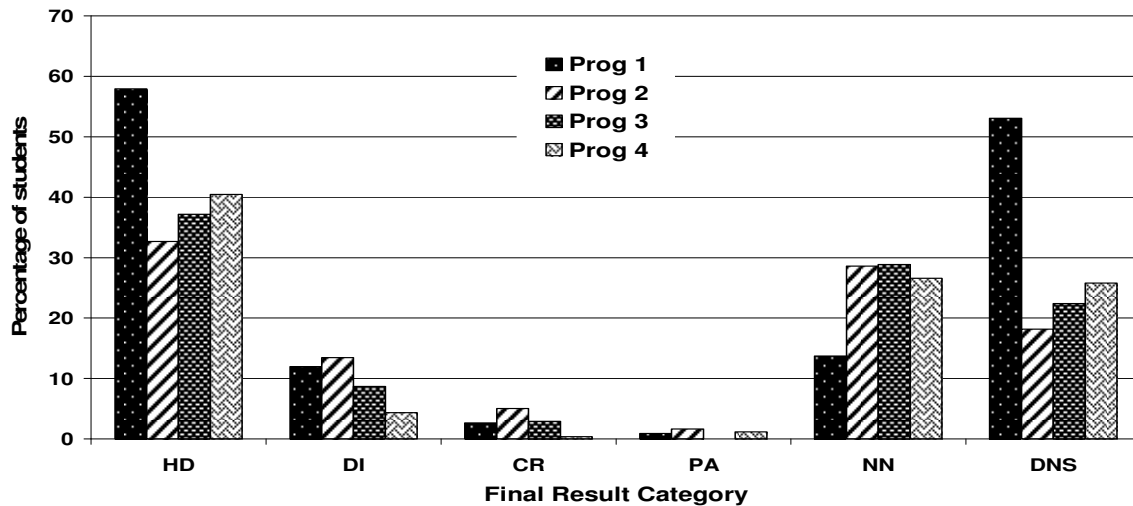


**Figure 4-17 Percentages of students who completed the assignments and exams and passed (IT1, 2, 3, 4).**

Hence we calculate the number of students who submit the assignments and appeared in the final exam which is presented as percentages in Figures 4-16 (Programming) and 4-17 (IT). The figures show that 70-80% of the students submit assignment 1 which decreases for the later assignments. Only 50-60% of the students submits the final assignments and sits for the exam. This trend

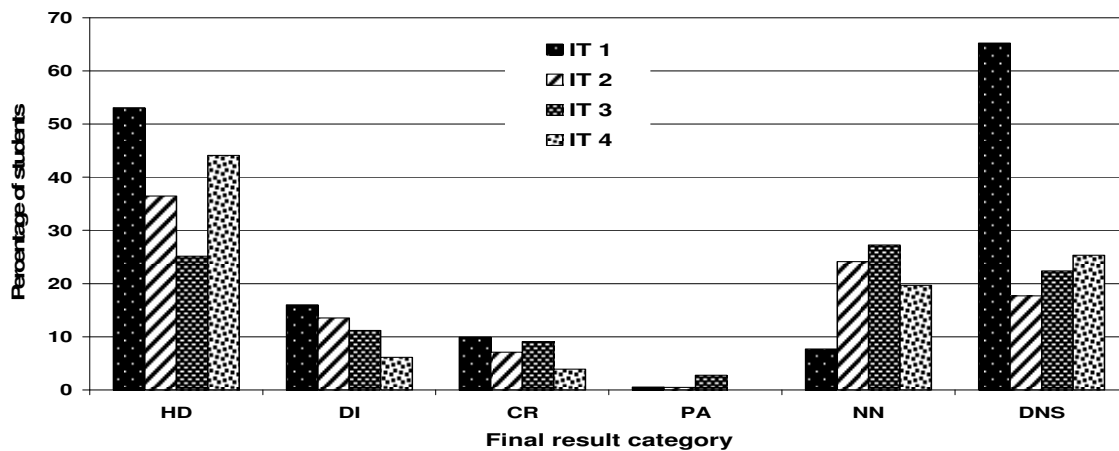
remains same for all the Programming and IT courses. Almost 95% of students who submit the assignments receive a pass mark while this number is approximately 80% for the final exam.

#### d) Overall Results



**Figure 4-18 Grades achieved (Prog1, 2, 3, 4).**

Figure 4-18 represents the grades of the students in the programming courses over the 4 study periods. On average around 30-40% of students achieve (High Distinction) HD results in the course out of those who continue till the end with the number being close to 60% for Prog1. This trend is similar for the IT courses and is presented in Figure 4-19. The highest rate of HD is during IT1 whilst the lowest being is 25% in period IT3.



**Figure 4-19 Grades achieved (IT1, 2, 3, 4).**

The noticeable factor is that almost 50-60% students in both Prog1 and IT1 received “DNS” as a result of not submitting either assignments or not sitting for final exam. However this rate drops to around 20-25% in all the study periods in 2010.

## 4.2.2 Discussion

The data analysis and findings section has provided an overview of the number of students postings in the different discussion board threads, the number of postings throughout the study period, dropout rates and the grades in different assessments. One of the focuses of this research is on the participation and quality of interaction of the students and instructors in the discussion forum. By analyzing the survey responses, several themes are uncovered which can act as a basis for designing quality online participation and several important features which affect the quality of participation.

#### a) Impact of Assessment on Forums

Ramsden (2003) and Laurillard (2002) suggest that consistent participation enhances student learning and the strongest motivator for participation is to provide some incentive as students generally value assessment. Starting from 2009, (except Prog1), Group Discussion participation is assessed until the second study period in 2010. The effect is evident in Figure 4-13, where the number of group discussion posts is higher than the combined posts of “Welcome and Introduction”, “General Discussion”, “Assignment” and “Exam Discussion” threads. As soon as the marks are withdrawn, the numbers in the Group Discussion fell lower than the Main Discussion board in both the courses. From Figure 4-9, it is visible that Prog2 and 3 see more participation than other periods in 2009. Similarly from Figure 4-10, it is evident that IT1, IT2 and IT3 see more participation from the students than IT4. This leads us to conclude from this data that providing assessment marks for contributing to the discussion forum does have an impact on the participation of fully online students.

Klisc, McGill and Hobbs (2009) suggest that incorporation of assessment of participation has positive impact on learning outcome as well. However, the assessment marks for group discussion do not have any noticeable impact on the pass rate in the IT courses. In fact the pass rate in IT4 gradually increases compared to IT3 though marks are removed. Alternatively, the pass rates in the programming courses decrease by 2-3% after the marks are withdrawn.

#### b) Difference in Tutor Support

Nandi et al. (2011) found that difference in the number of instructors and tutors supporting the forum impacts student participation. This is one of the major factors that Garbic (2006) identified as motivators for online participation. The student-instructor (+tutor) ratio is around 80-100:1 for most of the study periods apart from Prog1 (346:1) and IT3 (40:1). As the ratio is only 40:1 in IT3,

instructors are able to provide more feedback and generate more discussion. This is evident from Figure 4-10, which shows average number of posts is consistently higher than other study periods.

However the impact of this difference is not noticeable in the grades and the dropout rates of the students. As expected the rate of “HD” and “DNS” is highest in Prog1, where there is no tutor support. However the pass rate in IT3 is lower compared to other IT courses even though the student-instructor ratio of 40:1 is the lowest. Hence it can be assumed that the quality of instructor and tutor support is more important than the quantity. The way instructors and tutors administrate and moderate the discussion forums need to be investigated.

#### c) Managing Course Content and Dropout Rates

Nandi et al. (2011) reported that management of course content has an impact on student participation. Releasing assignments sequentially or early impacts student participation as students consider these hurdles seriously and post early regarding the assignments. In the four study periods analysed, release times of assignments varies; in some of the courses all assignments are released together while in some courses they are released periodically. From observation we can state that timing of assignment release and submission does affect student participation online.

The dropout rate of the students is very high in both the courses. Around 50-60% (Figure 4-16 and 4-17) students actually submit the final assignment and sit for the final exam. Also around 20-30% students do not submit any assessment (Figure 4-11 and 4-19) or sit for the exam resulting in a very high “DNS” rate in 2009.

This stage has compared the course management, student activity and achievement in two fully online courses throughout 4 study periods. There are

certain factors that may affect the student participation and achievement and this stage of research has provided in-depth analysis of these factors over 4 study periods. The focus of this research is to compare the difference in course management and the resulting effect it has on the participation and grades. Results of our data analysis explain how student activity differs from period to period in reaction to the changes made in course management. Results show that assigning assessment marks for discussion plays an important role in increasing participation. Results also indicate that there is a high dropout rate in both the online courses but most of the students who continue in the courses achieve excellent results. The key lesson learned from this research is that mostly quality and not quantity of moderation by the instructors and tutors affect the student participation.

### **4.3 Summary**

The focus of this stage of research was to investigate the research question:  
*What are the important factors that affect student activity in fully online courses?*

We investigated this research question in two phases. In the first phase, we measured how active students are in online discussion forums and the correlation between this activity and the overall marks obtained in the subject. In the second phase we investigated what factors of the online environment or course management impact on student participation and achievement.

We find that large numbers of students are inactive and do not use discussion forums at all in their fully online study. We have shown it is beneficial to participate in discussion to achieve higher grades. We also found that managing the course content and student expectations impact participation.

Our findings also show that there is a high dropout rate in these fully online courses whereas most of the students who do continue achieve good grades. Hence it is important to get students to continue the course and increase participation.

In the previous chapter, we described the drivers for our research methodology. In the next chapter, Chapter 5, we investigate the student – student and student – instructor interaction and how a framework can be defined to ensure quality interaction among students and instructors in fully online courses.

# Chapter 5 - Framework Development

In this chapter we develop a framework based on their interaction online between students and instructors.

This chapter is divided into two parts where we investigate the following research questions:

- 1) *How can we evaluate quality interaction between students in fully online courses?*
- 2) *How can we define the appropriate criteria for the instructor to interact with the students in fully online courses?*

As discussed in Chapter 3 (Methodology), to accomplish the research objective, qualitative analysis was performed (Section 3.6.2) using a grounded theoretic approach to capture the inner meaning of the data (Strauss & Corbin 1998; Lechner 2001). Based on this analysis, some specific guidelines are proposed through which productive interaction in fully online courses can be ensured. Detailed description about the participants, data sources and the data analysis method has been provided in Chapter 3 (Methodology) in Section 3.6.2.

## **5.1 Student Interaction**

In order to carry out the analysis we choose one weekly discussion forum and one assignment discussion forum each from the two courses. On average 40-50 students are active in the selected discussion forums. Table 5-1 presents the themes that come out of the data analysis along with the number of times they appear related to student interaction.



Criteria		Introduction to IT (Number of times referenced during discussion in both IT1 and IT2) (%)	Introduction to Programming (Number of times referenced during discussion in both Prog1 and Prog2 ) (%)
Asking Questions	<i>Administrative (+ for assignments)</i>	1.15%	6.96%
	<i>Leading questions</i>	8.62%	0.87%
	<i>Questions drawn from own experience and real world situation</i>	9.77%	0
	<i>Straight and in detail</i>	10.34%	18.26%
	<i>With lines of code</i>	0	1.74%
	<i>To instructors</i>	1.72%	0
Answering Questions	<i>Straight and in detail</i>	14.37%	16.52%
	<i>With tips</i>	0	3.48%
	<i>With real world or own coding example</i>	12.64%	3.48%
	<i>Justification</i>	5.75%	6.09%
Acknowledgement for understanding		2.87%	0
Asking for feedback	<i>From students</i>	1.72%	2.61%
	<i>From instructors</i>	1.15%	2.61%
Clarification		9.20%	18.26%
Critical discussion of contribution		1.72%	1.74%

<b>Ideas from interaction</b>	1.72%	2.61%
<b>Opinions regarding the topic of discussion</b>	6.90%	0
<b>Providing feedback</b>	0	1.74%
<b>Sharing own experience and knowledge</b>	6.90%	6.96%
<b>Suggesting multiple solutions</b>	0.57%	0.87%
<b>Relevance</b>	All the posts	All the posts
<b>Informal posts</b>	2.87%	5.22%

**Table 5-1: Themes related to student participation and the number of times they appear in the discussion for IT1, IT2, Prog1 and Prog2 courses.**

The themes are discussed below along with the actual posts from the discussion forum.

### **5.1.1 Asking Questions**

Asking questions refers to queries regarding the course material or the management of the subject. We find that students ask lot of questions which shows they are active in the course. Frequently asking questions indicates that students try to grasp the subject material, want to learn and hence ask questions. It also shows that these students consider themselves within a virtual community of learners and feel free to submit their queries online.

Students ask different types of questions and we have classified the questions into the following categories.

a) Administrative (+ for assignments)

This type of question refers to the queries where students were trying to understand the management of the course, i.e. when are the tests due, what software to use and similar issues.

*< Will you be placing an answers section to the tutorial questions, so we can mark our own progress? > [IT2]*

*< Do we need to submit any documentation with this assignment? Either external documentation or internal //comments? > [Prog1]*

*< Sorry one more thing to clarify, we are able to use "Functions" & "Method Parameters" , but are NOT to create NEW ones? > [Prog1]*

*< I was wondering if there was some way once the first assignment had been uploaded to "weblearn" whether it could be further modified or retrieved. > [Prog2]*

Relatively few such administrative questions are asked.

b) Leading Questions

Leading questions refer to queries which come out of a post in the discussion board. It indicates that students have read the posts and do not fully understand the meaning prompting them to ask follow up questions, such as the following.

*< So if there is, for all intents and purposes, only one backbone to/from Australia, what happens when/if there is a serious disruption or disabling to that line. > [IT1]*

*< No, I didn't, I thought Imap was just a receiver. Are there any other protocols that can also send that we should know about? > [IT2]*

*< Is POP then the same thing as the POP3 thing that comes up occasionally in my outlook? I'm pretty sure it still comes up. > [IT2]*

*< Thanks, I don't understand. Would it be the "isShowing" property? >  
[Prog1]*

c) Drawn from Own Experience and Real World Situation

This type of question shows that students are trying to link the course material with the real world situations. Understandably, a lot of such questions are asked during the discussion in the IT courses, where most of the students are familiar with day to day use of IT.

*< Wasn't there an outage or limited outage of international web sites  
(Aussie ones were fine) access last week of some sorts? > [IT2]  
< Is the reason for lack of Backbone in Australia and more of a regional  
network is lack of investment due to small economics of scale? > [IT2]  
< Was that Telstra problem/outage with connectivity to the backbone? >  
[IT1]  
< When I access or send emails using a web-based account, such as  
yahoo or gmail, what protocols are at play? > [IT2]*

In comparison, very few such questions appear in the programming courses which may be due to the different nature of the subject material of the courses.

d) Straight and in Detail

These are straightforward questions posted by the students regarding the topic of discussion. There are lots of such questions posted in the discussion board in both courses.

*< Does instant messaging only involve text based conversations? Or  
videos chat too? > [IT1]*

*< Why does using / and \ after .....line shows an error in my html code?  
> [IT2]*

*< Quick question that's prob really simple but can't get my head around it.  
How do i open the Pre Programmed Skater in the Alice program? >  
[Prog2]*

*< A pretty basic question...Would someone please tell me if I leave  
policeCar.flash alone or is it supposed to be added to something. Does it  
just need to "be around" so the lights flash? > [Prog2]*

#### e) With Lines of Code

This type of question mainly appears in the programming course. It actually serves two purposes. Firstly, it shows that the student has tried to solve the problem and got stuck and secondly, it makes it easier for others to answer the query by looking at the code written so far.

*< This might be wrong but i used this: if: both(both: redbox is behind + to  
the right of) humvee + (both: blue box is behind + to the left of) humvee  
then police car vanishes..... Any thoughts? > [Prog2]*

*< If (humvee distance to redbox+humvee distance to redbox)=redbox  
distance to bluebox)*

*I'm having a major brain haemorrhage with this, I can only figure that it  
fails to be true because distance to is measured from the humvees edge  
rather than centre point. Any help appreciated much. Is there a better way  
that i am missing? > [Prog1]*

(Humvee, redbox and bluebox are objects from assignment 1 where students were required to compute the distances between each of these objects in the Alice programming environment, so the objects would not collide.)

f) To Instructors

These are straightforward questions directed towards instructors only such as the following.

*< How do you mean? Just as transport from the IMAP client to the server and then delivered by SMTP or another way? > [IT1]*

*< Are you able to elaborate on Q1. part 2 below as I seem not understand the question clearly. 1. Who (or what) is typically connected to each type of communication line? > [IT2]*

Sometimes during discussions, students get confused by the variety of information presented in the forum and ask direct questions to the instructors for clarification. Others ask to make sure they are on the right track before proceeding to further topics.

### **5.1.2 Answering Questions**

Answering questions refers to responding to the queries put up by the students or the instructors or providing solutions to the tutorial questions. Data analysis shows that students freely answer questions in different ways. Students post their answers in different ways and we have classified them in the following categories.

a) Straight and in Detail

This refers to answering questions in a straight forward manner. These questions might be asked by the instructors or posted by other students in the forum. This practice assists in sharing and reinforcing knowledge.

*< IMAP is more user friendly when opening mail from a whole range of devices ie mobile phone. > [IT1]*

*< Pop - simple server system that collects and holds the mail to you until you collect it*

*Imap - more complex system comprising of a collection of mail folders which are maintained by the server. 1 method of sending/uploading mail.*

*> [IT2]*

*< Try 'Quad View'. it sets up 4 different angle views... > [Prog2]*

*< Try an IF statement at the beginning of your 'Hummer moves forward' method to test the visibility of both vehicles before allowing any movement. > [Prog1]*

We find that, students mainly post such answers to tutorial questions as well as questions from other students.

#### b) With Tips

Answers with tips do not directly provide a solution for the question or the problem, but provides some guidelines depending on which solutions can be worked through. These types of answers are especially important while discussing assignments where students and instructors are not supposed give away the solution through their answers and instead just provide some clues.

*< Just a quick tip X ... > [Prog1]*

*< Look very carefully at all of the proximity functions and you'll find one that is more suitable. > [Prog1]*

*< Yes, you can have objects that are composed of other objects. In this case the bird object is composed of other objects (right wing, left wing, etc) and as you say they to have their own methods and properties. > [Prog2]*

Understandably, these types of answers are mostly seen in the introduction to programming course as writing the code would give away the actual solution.

#### c) With Real World or Own Coding Example

Providing examples while answering questions allows students to link the theory with real world practice. A lot of such types of answers are seen in the IT courses. This assists students to apply theory into practice while answering questions as well as other students can learn from it in the same way. Students also post programming codes as example but not as extensively as done by the IT students.

*< Twitter has just removed XMPP for latency concerns. > [IT1]*

*< Ok in Australia Adsl would be the most popular but i think in more populated countries like USA, UK , China etc Cable would be more popular. > [IT2]*

*< I have attached my file as an example it shows how the methods are combined to form a routine. > [Prog1]*

*< I have solved the problem with a few more IF statements. :) > [Prog2]*

These posts assist students to apply theory into practice while answering questions as well as other students could learn from it. We find that Students also post programming codes as example.

#### d) Justification

Justification refers to providing clear rationalization for the posts while participating in online forums. It acts as a source of validation for a specific comment. We find that students try to justify their answers in different ways e.g. (as mentioned above) by providing a link or the source for the information or by providing examples that shows the application of the theory.



Answering questions with a source or link is an excellent way to justify the answer. It assists others in the discussion board to verify the answer by visiting the links and acquire more knowledge by reading them. Students in both courses are found to provide source or link while answering questions.

*< In direct answer to your question Ryan, protocols in a nutshell are simply a set of rules that tell computers how to communicate with each other. The most commonly thought of rule being the port number to use (ie, 80 for HTTP, 25 for SMTP, 21 for FTP and so on), There is what I think is a great explanation on Wikipedia*  
*([http://en.wikipedia.org/wiki/Protocol\\_\(computing\)](http://en.wikipedia.org/wiki/Protocol_(computing))). > [IT1]*  
*< This link explains it well and in detail of just what I said.*  
*<http://www.ltg.ed.ac.uk/~ht/WhatAreURIs/> > [IT2]*  
*< This article outlines the terminology that I mentioned quite well -*  
*[http://computerprogramming.suite101.com/article.cfm/procedure\\_\\_subroutine\\_or\\_function\\_](http://computerprogramming.suite101.com/article.cfm/procedure__subroutine_or_function_) > [Prog1]*  
*< Try using VLC media player it will play near anything and works great for me..... <http://vlc-media-player.en.softonic.com/> > [Prog2]*

We identify that the above posts assist others in the discussion board to verify the answer by visiting the links and acquire more knowledge. Students in both courses are found to provide source or link while answering questions.

### **5.1.3 Acknowledgement for Understanding**

Acknowledging for understanding a concept through discussion is an indication that the discussion is productive. It also inspires other students to engage in an effective discussion.

*< I think it's very interesting that I have been using the term URL for years and never fully understood what it consisted of, in my naivety i just assumed it was another term for website address, now I finally understand. > [IT1]*

*< Thank you so much your information has been really helpful I think i understand now:-) > [IT1]*

*< After viewing some of the posts i think I now know how this part of html code works :-) > [IT2]*

*< I was a bit confused in trying to get an understanding as to who owns the backbone i was somehow under the impression that the back bone was government owned. > [IT2]*

#### **5.1.4 Asking for Feedback**

Asking for feedback refers to posts where students posts a comment or a solution to a problem and asks other students or instructors for verification of the correctness of their answers. It shows that students are free to communicate with each other and as a result other students also reply with their comments which create a thoughtful interaction online. We find that students in both courses ask for feedback from both other students and instructors.

##### **a) From Students**

*< Am I on the right track here? > [IT1]*

*< Am I going on the correct way? > [IT2]*

##### **b) From Instructor**

*< Correct me if I'm wrong, please X. > [IT1]*

*< So.Mr. X, Could you please shed some light on this. > [Prog1]*

It shows that students are free to communicate with each other which create a thoughtful interaction online. Students in both courses ask for feedback from other students and instructors.

### 5.1.5 Clarification

Clarification refers to explaining the posts in clear and concise way so the meaning can be easily understandable by everyone. This is one of the most important criteria for participating in any discussion forum. Technical courses like IT or programming have a lot of scope for misunderstanding and misinterpretation.

*< The relationship between International backbones are as follows: Shark eats Big fish which eats little fish which eats even littler fish :) i.e.*

*Backbone > Regional Network > ISP's > Me. > [IT1]*

*< My PC > My ISP > My Regional Network > Backbone - Backbone > your Regional Network > Your ISP > Your PC. > [IT2]*

*< Objects in the Alice world will have both "properties" and "methods" - properties are like the attributes of an object for example its colour, the methods will be action the object is capable of performing - such as moving. > [Prog1]*

*< Actually it makes more sense than not to include the police car moving in the same method. It only occurs after the humvee moves. > [Prog2]*

We find in all courses that, students try to clarify their posts so that their argument can make logical sense to everyone in the discussion forum.

### 5.1.6 Critical Discussion of Contribution

Critical discussions of others' posts refer to agreeing or disagreeing with the posts and providing a logical explanation for that agreement or disagreement. This assists students to think critically and logically about the course topic in discussion. It also facilitates other students to reflect on their posts and consider different ways to answer a question or solve a programming problem.

*< "Why would you choose the more expensive VoIP telephone over a standard telephone?"*

*You say "the more expensive VoIP". I don't know what the costs are but isn't the purpose of VoIP to supply cheap call rates using internet technology. > [IT1]*

*< Your statement "Each messaging system was designed by someone with their own interests at heart so just about every new system has a different protocol" I think can be expanded upon. Generally it's true but there are protocols that are designed to be used by many people and shared. > [IT2]*

*< I had a look at your code X and it did not go back to basics at all - In fact it was very convoluted and there were quite a few empty methods or methods with only one line of code. > [Prog1]*

*< It appears your trying to overcomplicate something that is relatively simple ...> [Prog2]*

We identify that very few students critically discuss their peer's posts, and this criterion should be encouraged by the instructors.

### 5.1.7 Ideas from Interaction

Ideas from interaction refer to when students learn some new concept from other students and use that knowledge to solve a certain problem or answer a question.

*< I think there can be more than one backbone per area, because as Alison said, what if one gets disrupted, we would be completely cut-off. > [IT1]*

*< I think what you said can be expanded upon. Generally it's true but there are protocols that are designed to be used by many people and shared. > [IT2]*

*< Interesting that you point that out X. I have just noticed with the monkey example on pg 45 of the text that even though the instruction states the monkey moves left when you run the scene the monkey appears to move "right". > [Prog1]*

*< Thanks hips, i didn't try "forward", because worried that her upper torso would actually leaving her lower torso, I'll try it now n c what happens. > [Prog2]*

This criterion shows that interaction is productive as students are learning from each other.

### 5.1.8 Opinions Regarding the Topic of Discussion

Mere opinion based posts may not be very helpful for other students. However it certainly triggers discussion where students reply with their own knowledge and creates an atmosphere for knowledgeable discussion.

*< I think the terms "URI" and "URL" are almost interchangeable. > [IT1]*

*< I think that the benefits of using VOIP technology is that you can call anyone in the outside world on different voice devices, such as standard telephone lines, mobile phones and other computers. > [IT1]*

*< I would think instant messaging is not possible on a standard phone. > [IT2]*

*< I think there is only one backbone with numerous backbone providers for say Australia in which ISPs and then end users are connected. > [IT2]*

We find that students post their opinions about the course material in the IT courses and interestingly, as noted previously, none in the programming courses. Almost every time these types of opinions are posted, productive discussion triggers.

### **5.1.9 Providing Feedback**

Providing feedback to each other is a criterion which shows students are freely assisting each other to develop knowledge.

*< I completely agree with your statements. However I am sure that it is all workable with the left right things. > [Prog1]*

*< Nice implementation of "messagebox" functionality as a "debugging" tool mate!! :) > [Prog2]*

We do not find this criterion frequently in the discussion and only occurs twice in the programming course.

### 5.1.10 Sharing Own Experience and Knowledge

We identify that students in both courses share their own experience while interacting in the discussion board. Sharing their own experience about solving a problem provides an assurance to others that certain IT or programming problems can be solved in that way.

*< I've used Lotus Sametime at a company I worked for and it uses the same SIP as googletalk. > [IT1]*  
*< I use it because it runs on a variety of operating systems (I use it on OSX/Windows (7) and Linux. It also runs on 64 bit variations of these OS (Well have not got snow leopard yet). > [IT2]*  
*< We use Nortel at our work and it pretty much works the way you had mentioned, each VOIP phone gets logged in with an IP address. > [IT2]*  
*< here here!! I have found out by doing the prac that we were given, that the "objects" (skaters, cows, etc) move in relation to the way they are facing ... not the in relation to the camera. [Prog1]*

The above quotes indicate that students attempt or complete the task before sharing their experience and learn through it.

### 5.1.11 Suggesting Multiple Solutions

Suggesting multiple solutions for a single problem shows that the student has done some research regarding that problem. It also assists other students to consider different angles about certain problems or questions and in this way acquire more knowledge.

*< The alternative would be to use the corresponding IP address which isn't really the most user friendly approach in terms of remembering a bunch of seemingly unrelated random numbers. > [IT2]*  
*< This is more than one way to sin a cat ;) Thoough .. that is the best way . not necessarilly the only way :) > [Prog1]*

We find that these are the only two multiple solutions suggested in either discussion forum.

### **5.1.12 Relevance**

Relevance in participation refers to posting comments which are directly or indirectly related to the subject of discussion. Almost all the posts are also relevant to the topic of discussion apart from a few informal posts.

### **5.1.13 Informal Posts**

We observe some informal posts in the discussion forum. Being a part of a community of learners makes it easier for them to post some informal funny messages.

*< The day i get fibre inside my apartment, is the day i will stop arguing about internet.:) lol > [IT1]*  
*< Sweet dreams and remember ice packs for the flying fingers. :-P > [IT2]*  
*< The world is "large", u didn't get lost, just shift the world, u can find "yourself "again:-) > [Prog1]*  
*< Cheers, X, (The Cunnamulla Fella) :) > [Prog2]*

This type of informal posting makes the discussion “light hearted” and hence more interesting.



## **5.2 Discussion**

On a general level students are making most of their online forum discussions to gain, share, deepen and expand knowledge. A number of criteria in the area of cognitive skills (Henri 1992; Newman, Webb & Cochrane 1996; Nandi, Chang & Balbo 2009) use of both formal and informal language (Henri 1992; Gerbic 2006; Nandi, Chang & Balbo 2009) and frequency of participation (Henri 1992; Nandi, Chang & Balbo 2009) were evident. Themes such as justification of posts, clarification of ideas, critical discussion of contribution, suggesting multiple solutions are valued and exercised by the students regularly. Some of the criteria from Table 2-1 (Nandi, Chang & Balbo 2009) are not evident in the discussion while some new and different themes emerge from data analysis. A number of Criteria such as prioritization and interpretation (Nandi, Chang & Balbo 2009) are not directly evident in the discussion.

The main tasks that students are performing in the discussion forum are asking and answering questions. Research done so far analyzing themes for online participation (Henri 1992; Newman, Webb & Cochrane 1996; Nandi, Chang & Balbo 2009; Garrison, Anderson & Archer 2001) largely focuses on how to answer questions and not on how the answers can be justified. Most of the themes provide a guideline on how quality responses should be posted in online forums. This research verifies most of them as we find that students use source or link and examples while providing answers and want others to justify their responses.

Different types of questions are being asked by the students in the two courses which trigger discussions most of the times. We have classified the questions into six categories. They are: Administrative (+ for assignments), leading questions, questions drawn from own experience and real world situation,

straight and in detail, with lines of code and questions directed to instructors. Almost 50% of the posts in both the courses are questions and answers from the students. Second in the list is clarification which consists of around 9% and 18% of the posts in the IT and programming courses respectively.

Researchers argue that comments or answers posted online should be accurate and backed up by justification or clarification (Edelstein & Edwards 2002). We find out that posting opinions can also be useful as it assists in triggering discussion. Research carried out by Blignaut and Trollip (2003) and Burstall (2000) suggested that controversial posts attract enhanced interaction. Opinions posted in this course might not have been controversial, but have attracted lot of discussion on the comments. This criterion is only visible in the Introductory IT courses, where students probably have an idea about the uses of information technology in their day-to-day life and try to relate it with the topic of discussion.

As discussed in previous chapter, course content has an impact on online participation (Nandi et al. 2011). We find that while discussing online, students point towards examples and real world situations from the past and current use of information technology in their personal and work life which manage to broaden the discussion. This could explain why more questions (9.77%) and answers (12.64%) drawn from own experience or real world situations are posted in the introductory IT courses and very few in the programming courses (3.48% only answers). Alternatively, a lot more administrative questions are asked in the programming courses (6.96%) than the IT courses (1.15%), where students try to be acquainted with which software to use and how to install. It confirms the findings (Nandi, Chang & Balbo 2009) that the relative importance and the relevance of the each theme depends very much on the instructors, the course content and the cohort and demography of the online students.

### ***5.3 Quality Framework for Student – Student Interaction***

Based on the findings of this research, we have modified the framework presented in Table 2-1 (Nandi, Chang & Balbo 2009) and present a new framework in Table 5-2 for evaluating quality of student interaction in fully online courses. This new framework consists of 11 criteria and assessment guidelines for each criterion.

<b>Criteria</b>	<b>Poor</b>	<b>Satisfactory</b>	<b>Good</b>	<b>Excellent</b>
<b>Asking Questions</b>	Asking irrelevant questions	Questions from subject matter or topic of discussion	Questions with clear background	Questions indicating ability and evidence to carry out research
<b>Answering Questions</b>	Providing wrong answer	Posting correct answers	Providing detailed answers	Detailed answers with examples and suggesting multiple solutions if applicable
<b>Justification</b>	No justification of points	Justification based on personal opinion	Justification using existing cases, concepts or theories	Justification using existing cases, concepts or theories and providing clear discussion of implications
<b>Clarification</b>	Regurgitation of information	An clear explanation of available information	Explaining available information using relevant examples	Articulating available information to expand on ideas presented, including the use of examples

<b>Critical Discussion of Contribution</b>	No engagement with other learners' contributions	Some basic discussion about other learners' contributions	Consistent engagement with other learners' contributions and acknowledgement of other learners' comments on own contributions	Contributing to a community of learners, with consistent engagement and advancement of each other's ideas
<b>Ideas (+New) from Interactions</b>	No evidence of new ideas and thoughts from interaction	Some new ideas developed as a result of interaction	Some solutions and new ideas as a result of interactions	Collaborative approach to solution seeking and new ideas developed
<b>Posting Opinions</b>	Opinion on irrelevant topic	Opinions on relevant topic	Opinions that trigger discussion	Opinions that indicate the knowledge of the subject matter and prompts feedback
<b>Providing Feedback</b>	Wrong and short feedback	Accurate feedback	Detailed feedback	Detailed feedback with acknowledgement for understanding if applicable
<b>Sharing Knowledge and Experience</b>	No sharing of outside knowledge	Sharing generic information that is easily available	Sharing real world examples that may not be	Sharing real life knowledge, personal experience and examples of similar problems/solutions

		from outside sources	immediately obvious to other learners	
<b>Relevance</b>	No application or discussion of relevance to questions asked	Application of knowledge to questions asked	Application of knowledge including discussion using relevant examples	Knowledge is critically applied and may include discussion of limitations
<b>Using Social Cues to Engage other Participants</b>	No engagement with others in the discussion forum	Answering some basic question posed by facilitator or other learners	Engaging with the work and discussion of other learners	Engaging and encouraging participation with fellow discussants in the forum

**Table 5-2: Framework for evaluating interaction quality between students.**

We did not include the criteria of “objective measures” (Nandi, Chang & Balbo 2009) in this framework and intend to investigate on this criteria in future.

## ***5.4 Instructor Contribution***

The following table (Table 5-3) presents the themes that we have uncovered through data analysis along with the number of times they appeared in the discussion during the period data was collected. These themes provide an overview of how instructors (+tutors) facilitated the discussion forums.

<b>Criteria</b>	<b>Introduction to IT (Number of times appeared in the discussion in both IT1 and IT2) (%)</b>	<b>Introduction to Programming (Number of times appeared in the discussion in both Prog1 and Prog2) (%)</b>
<b>Administrative guideline or technical assistance</b>	2.65%	8.93%
<b>Clarification of questions</b>	0	7.14%
<b>Declaration of expectation</b>	15.93%	3.57%
<b>Periodic intervention to direct and extend discussion</b>	17.70%	0
<b>Promoting deep learning</b>	4.24%	19.64%
<b>Providing direct answers</b>	9.73%	50%
<b>Providing feedback with example</b>	15.04%	0
<b>Providing feedback</b>	18.58%	10.71%
<b>Raising new questions</b>	15.93%	0

**Table 5-3: Themes related to instructor participation and the number of times they appeared in the discussion for IT1, IT2, Prog1 and Prog2 courses.**

The Table 5-3 presents the themes that come out of the data analysis along with the number of times they appeared related to instructor contribution in the two fully online courses. The themes are discussed below along with the posts from the discussion forum.

#### **5.4.1 Administrative Guideline or Technical Assistance**

Administrative guideline refers to the rules and regulations of the course and the strategies that should be followed by the students. We find through data analysis that instructors and tutors provide guidelines and technical assistance during the initial weeks of the course.

*< There are two group discussions boards, located away from the main Assignment discussion board. > [IT1]*

*< A lot of this thread is 'information overload', but do keep in mind what is course-related, and what is extension. If you are feel you are falling behind, stick just to the tutorial questions. :-) > [IT2]*

*< Be (a bit) warned, 2.2 is still classified as beta, the only really safe one at the moment is 2.0. > [Prog1]*

*< The a2w files must be opened from within alice, double clicking on them may open them in a zip program for extraction, there are actually all the objects required for this assignment zipped into one file by alice. > [Prog2]*

This guidance makes it easier for online students to settle down and get in to the subject materials easily. It also clarifies which software to use or not to use and how to get the best out of a fully online course. As the students are fully online, this is essential, as it sets the tone for the study ahead.

### 5.4.2 Clarification of Questions

Clarification refers to a clear explanation of the problem statement or questions which clear up any confusion students might have regarding the question itself. We identify this theme as only evident in the programming course where instructors try to clarify the problem scenario.

*< The restrictions state new functions, new methods are definitely permitted and encouraged. > [Prog1]*  
*< It really shouldn't matter which you test first (unless the caught / escape is just so close), what I am after is can you detect both caught and escape conditions. > [Prog1]*  
*< Yes, you can use the existing Alice Functions and method parameters, but must NOT create new ones. > [Prog2]*

Mostly evident in the assignment discussion, this theme allowed students to think in the appropriate way to solve a certain problem.

### 5.4.3 Declaration of Expectation

It is important for the instructors to set expectations which assist the students to understand what the instructor wants out of them and act accordingly. It specifies what the students should be doing to achieve the ultimate goal of learning in the course.

*< I would like to take this opportunity to lay out some expectations and general guidance for how tutorials will work, since I'm pretty certain some of you are unsure of how it all works! > [IT1]*  
*< Participate in tutorial discussion for one group for each week. > [IT1]*



*< It's not something that would be examined; it's a point of extension for those whom are curious. > [IT2]*

*< Note - none of the exercises in chapter 1 require programming, The first paragraph of the chapter states that the object of these exercises is to create an initial scene, by setting up the characters in their starting positions. > [Prog1]*

Particularly in a course like Introduction to Information Technology, which covers vast areas from the field of IT, it is important to clearly state expectations, in appropriate contexts like above.

#### **5.4.4 Periodic Intervention to Direct and Extend Discussion**

Extending of discussion refers to continuing the ongoing discussion by broadening focus while ensuring it does not get halted at a certain point. Consistent intervention by the instructor keeps the discussion always on track. This intervention also assists in keeping away any irrelevant topics to be discussed online.

*< For those who would like a little more to debate about, a valid point was raised between cable TV and cable internet. > [IT1]*

*< Think about, for eg, ADSL. It uses the phone line. Can you still use it whilst ADSL is on? > [IT1]*

*< What about those users who don't have telephone lines installed? What do they do? Have you perhaps considered wireless internet as a possible solution? How does that work?> [IT2]*

*< Why do you think other countries would have Cable more popular? Do you think all cables are fiber optic? > [IT2]*

We find this theme only in the IT courses and not once in the programming courses. This verifies the hypothesis (Nandi et al. 2011) that it might not be easy to extend a discussion in an introductory programming course. The course content is narrow and often has one solution to a problem.

#### 5.4.5 Providing Feedback

Periodic and summarized feedback is regarded as one of the major roles of the instructors (Mazzolini & Maddison 2007). Feedback provides the students with overview regarding whether they are on the right track or not.

*< X was on the right track and Y nailed it here. > [IT1]*

*< X, remember there is a very fine line between a normal post and an educated post. But by the end of this course, I guarantee you'll be one of the educated ones! :-) > [IT1]*

*< Yes, you can have objects that are composed of other objects. In this case the bird object is composed of other objects (right wing, left wing, etc) and as you says they to have their own methods and properties. > [Prog1]*

*< I am assuming you mean the distance between the cars, distance to is measured between the center axis of the two objects, don't worry too much about it looking right, what I'm after is not the aesthetics. > [Prog2]*

Periodic feedback from instructors and tutors are provided in the both the courses. Mostly evident in the IT courses, this theme assists students to clarify their way of thinking and determine a solution.

#### 5.4.6 Providing Feedback with Example

Feedback with an example explains to the students in which way they should be concentrating on solving the problems. We observe this theme was only in the IT courses.

Examples provided by the instructors such as sample code for a problem, or examples of how a network structure works, are probably considered as the most credible source of information by the students,.

*< I guess you've got a point here - latency is just as much about quality of connection, as it is speed. If your regional network is bad, having a super-fast connection to your exchange won't make much of a difference, as well as how many computers/apps are using your bandwidth at the same time. > [IT1]*

*< And yes, it has gone through the right channels, and is very close to being passed. If Mr. Minister X knows what is good for him, he's tell Minister Y to lay off and scrap the entire thing! > [IT1]*

*< Not really, since most of these are private commercial deals that us mere mortals are not allowed to know. :-) > [IT2]*

*< You are pretty much spot on, except that the regional networks that connect the coastal cities, they are owned by Telstra (for the most part), and Telstra leases those to ISPs (EG Telstra Bigpond, Optus, TPG,e.t.c). > [IT2]*

We find feedback with examples from instructors appearing 11 times during the two weeks in the course. This again can be tracked back to the difference of content between the courses as the opportunity to provide feedback is greater in the IT courses than programming.

### 5.4.7 Promoting Deep Learning

Providing hints for discussion refers to, not proving the answers directly and provoking the students' thinking process by providing certain helpful clues. It assists the discussion to ahead and helps students to find solutions through those hints and tips.

*< The simple idea of this question is to get you thinking about the differences between Cable and ADSL. > [IT1]*

*< Before tackling this question, think about discussing... Who is your Internet Service Provider? Who do you think provides their backbone? > [IT2]*

*< Have a look at the order you have your test and movement. > [Prog1]*

*< You have just answered your own question; think about what you said in the question. > [Prog2]*

Providing hints for discussion to promote deep learning is a feature in both the courses, especially in the programming courses.

### 5.4.8 Providing Direct Answers

We identify lots of direct answers by the instructors. They assist students to learn what the solution to a problem is and can verify their own research. However students should be provided enough time to engage with the problem before giving away direct answers.

*< Fiber to the node is where there is Fiber Optic cables to the exchanges and so on. > [IT1]*

*< It's important here to differentiate between upstream and downstream. IE, as an example here, regional networks are connected to the backbone*

*on the upstream, whilst they are connected to the ISP's on the downstream. > [IT2]*

*< This is not a programming exercise, in this you are meant to move the soldier's arms with your mouse. > [Prog1]*

*< It is just meant to get you to move the arm into the salute position, either by using the menu or dragging with the mouse. > [Prog2]*

#### **5.4.9 Raising (new) Questions**

Asking new questions provides the students with a chance to explore more than the course material and learn more.

*< Can I ask you to clarify here? Are you trying to ask if the entire backbone is telephone based? If so, do you believe a telephone backbone is fast enough or reliable enough to be used? > [IT1]*

*< Can you think of a reason why this is so? > [IT1]*

*< Do you think the benefit would be great anyhow? > [IT2]*

*< These are all great points, but can you perhaps think of when a ISP would only have one backbone? > [IT2]*

Only evident in the IT courses, this theme is used by the instructors' lots of the times during discussion and never in the programming courses.

### **5.5 Discussion**

We find Instructors playing an active role in initiating and carrying on the discussion forward. Data analysis indicates that periodic feedbacks from the instructors are always valued highly by students and keeps the students on track. This results validate that handing students the responsibility to direct discussion

is not always the best option (Moller 1998) and instructors should be in control of the discussion at all times through an active presence. We have identified lots of questions being asked by the students in both the courses which could explain why instructors provide so many direct answers. In the programming course, 50% of the posts by the instructors are direct answers to questions and none is related to extending or directing discussion. On the contrary, only 9.73% of the posts in the IT courses are direct answers and 17.70% are related to extending discussion which clarifies the impact of content on discussion. It depends on the instructor of the course to draw a balance in between these two criteria of answering direct questions and providing clues or hints while facilitating discussion.

Investigation of the data points out that it is important to provide administrative or technical guidance early in the course. Technical courses like IT and programming can sometimes be hard to study initially and the fully online environment of study adds to that problem. Students also need to know which software to install and guidance on how to install it. Around 7% of the posts by the students in the programming courses are related to administrative issues and around 9% of the posts by the instructors are responses to those questions. Hence clear and detailed guidelines assist the students to get accustomed to the fully online mode of learning.

Instructors should declare early in the course their expectations of the students regarding how to participate and acquire the best out of the discussion forum. This declaration may consist of directions regarding how many and how often students should post in the discussion board, what should be the pattern of their contribution, how the students should approach the subject and in general what is expected of them. The expectation might be different considering the difference in the content of the courses (Nandi et al. 2011). Hence through specific subject wise guideline, students can follow the guidance and try to achieve the goal of learning accordingly.

Instructors set up threads named “Welcome and Introduction” reserved exclusively for students to introduce themselves in both the courses. Hence a lot of the posts in the first teaching weeks of the courses allow students to introduce themselves and meet each other virtually. On-campus students enjoy the benefits of easily establishing a group to study together. Therefore a sense of virtual community is required so that students can feel free to interact with each other and share knowledge and ideas. The initiatives for building the virtual community need to be taken early in the course where students should be allowed to communicate with each other and introduce themselves to “break the ice”. The above discussion clarifies that instructors and tutors fulfilled all the criteria mentioned by Mazzolini and Madison (2007) as the ideal role of the online instructor.

## ***5.6 Framework for Instructor Contribution***

Through an extensive review of literature, Baran et al. (2011) identified the ideal role of an online instructor. Our research has been investigating how the instructor’s role might influence the quality of interaction in a fully online computing course. Based on our research presented in Table 5-3, where we identify the roles played by instructors in online discussion forums, we have matched these with the roles identified by Baran et al. (2011) for the appropriate instructor, and now present a new framework in Table 5-4 to provide implementation guidelines for online instructors. This framework can provide an instructional guideline for the instructors regarding which role to perform and how to execute them. This framework can also be beneficial for large classes where instructors are assisted by tutors and individual roles can be clearly divided and defined.

<b>Ideal role of an Instructor (From Baran et al. 2011)</b>	<b>How to Implement them (Based on our research)</b>
<b>Managerial and Instructional Design</b>	<ul style="list-style-type: none"> <li>• Providing administrative guidelines</li> <li>• Declaring expectations</li> </ul>
<b>Pedagogical</b>	<ul style="list-style-type: none"> <li>• Clarifying questions and problems</li> <li>• Periodic intervention to direct and extend discussion</li> <li>• Promoting deep learning</li> <li>• Raising new questions</li> </ul>
<b>Technical</b>	<ul style="list-style-type: none"> <li>• Proving technical assistance</li> </ul>
<b>Facilitator</b>	<ul style="list-style-type: none"> <li>• Providing direct answers</li> <li>• Providing feedback (+ with examples)</li> </ul>
<b>Social Role</b>	<ul style="list-style-type: none"> <li>• Initiatives for community building</li> </ul>

**Table 5-4: Ideal role of an instructor and how to implement them online.**

## **5.7 Summary**

In this chapter, we have investigated the quality of interaction with a view to evaluating quality in online discussions in fully online courses by analyzing the discussion forum participation. Due to the exploratory nature of the research, the major focus was to identify key themes which apply to online forums in fully online introductory IT and programming courses. A number of issues relating to effective online participation and engagement were discovered through the analysis.

In order to have a better understanding of what it means by “quality” of participation, two major areas were looked at including type of participation by the students and facilitation activities by the instructor. The results and the frameworks define a set of criteria for quality participation for interactive learning.



Results of the data analysis show that students are actively participating in the discussion. Asking and answering questions are highly valued and exercised by the students. In response, instructors post both direct answers and hints to promote deep learning depending on the course content. Instructors also actively attempt to extend discussion and raise new questions in the IT courses and provide feedback with examples which is relevant to the course content.

Our research has shown that, rather than designing a fully student-centered or instructor-centered discussion, a combination of both the approaches can be advantageous. This requires both the students and instructors to take responsibility to construct and share knowledge and ideas. Students can have guidance on what is expected of them through our framework (Table 5-3). Instructors and tutors can design their role and workload through the framework proposed in Table (5-4). The themes and frameworks presented in this chapter provide clear guidelines that can be used as design principles for developing and supporting a quality discussion forum in fully online courses.

The next chapter, Chapter 6, describes the evaluation of the two frameworks developed in Chapter 5 for student – student interaction and Instructor contribution and which criteria are valued highly by the students.

# Chapter 6 - Evaluation of Frameworks

In this Chapter 6, we describe our research where we design, administrate and conduct surveys with both closed and open-ended questions to evaluate the frameworks. A description of the design of the survey and the participants has been provided in Chapter 3 (Section 3.6.3), Methodology. Through this survey, we challenge the set of criteria in both the frameworks and the relative importance of each of the criteria according to the students. Depending on the survey response analysis, we modify the frameworks and the process is presented in this chapter.

## ***6.1 Survey Data Analysis***

We design, administrate and analyse surveys (Appendix A) for the students in four of the chosen courses which are Prog1, Prog2, IT1 and IT2. The themes derived from the analysis provide a clear representation of what the participants regard as quality and productive discussions between students and instructors and how they actually participate in the forums.

Table 6-1 provides the number of survey respondents from each course and a general overview of the background information of the students. The survey response rate is in between 7-10% (67 responses in total), which can be considered typical for fully online courses (Sax, Gilmartin & Bryant 2003). Prior research has also shown that around 50% students in both the courses did not access the discussion board throughout the study periods (Nandi et al. 2011). However the participant number of 67 is well above the suggested sample size for grounded theoretic approach (Mason 2010; Creswell 1998 (p.64); Morse 1994 (p.225)).

Course	Number of Survey Respondents	Study Level (%)		Age Level (%)			First time Online (%)	
		UG	PG	20-30	30-40	< 20 and >40	Yes	No
Prog1	15	95	5	70	30	0	80	20
Prog2	19	98	2	60	40	0	80	20
IT1	12	95	5	60	40	0	70	30
IT2	21	97	3	50	50	0	80	20

**Table 6-1: Overview of the survey respondents.**

## ***6.2 Responses to Closed Questions***

Table 6-2 below presents an overview of students' responses to the closed questions on the survey (Appendix A). Students were presented with 16 statements which they were asked to rate using a 5 point Likert scale. From the table (Table 6-2), it is clear that most respondents feel at ease with the structure of the online discussion forums and considered learning online to be an advantage.

Criteria Statements	SD	D	N	A	SA
1. The setting and structure of the online discussion forum was easy to follow initially	0	7.7	15.4	61.5	15.4
2. During the use of the online discussion forum do you consider that you are part of a community of learners	0	15.4	7.7	53.8	23.1
3. Did you find that being able to post any time or anywhere as an advantage	0	0	7.5	23.4	69.1
4. Do you feel the online discussion forum	0	0	7.7	53.8	61.5

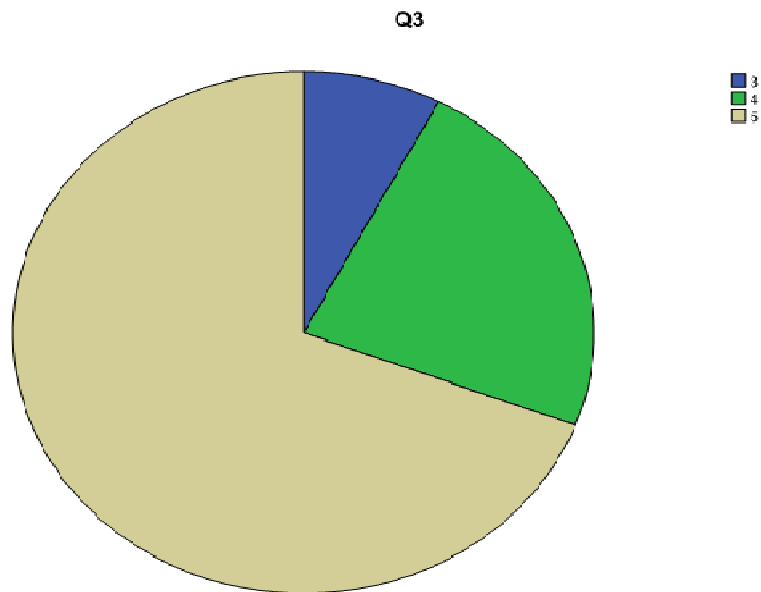
gave you more time to reflect on what you wanted to ask/answer allowing you to process your ideas better					
5. Do you prefer working in a team to collaborate rather than an individualistic approach, working on your own	0	38.5	0	30.8	30.8
6. The online discussion forum has been useful for learning and understanding of concepts or a subject	0	7.5	0	53.8	38.7
7. Do you feel it is an advantage if all students participate equality and consistently	7.7	23.1	38.5	23.1	7.7
8 .Do you feel students should raise new issues/directions about the topic of discussion in the forum	0	7.7	23.1	53.8	15.4
9. Do you feel students should justify their opinions through proper references	5.5	30.8	25.3	38.5	0
10. Do you feel students should bring in outside knowledge as example while discussing about a topic	0	7.7	30.8	46.2	15.4
11. Do you feel students should critically assess each other's posts	7.7	23.1	38.5	23.3	7.5
12. Do you feel students should use informal language or social cues sometimes to lighten the discussion	0	7.7	7.7	46.2	38.5
13. Do you feel instructors/tutors should be actively involved in the discussion	0	0	0	53.8	46.2
14. Do you want instructors/tutors to answer your questions rather than students	0	0	46.2	23.1	30.8

15. Do/did you ever feel that this online environment hampered your efforts to understand/learn a specific concept in the subject	30.8	23.1	15.4	30.8	0
16. Do you feel that you are learning the necessary skill of problem solving through this online environment	0	0	23.1	53.8	23.1

**Table 6-2: Percentage of responses to closed survey questions, where SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree.**

From Table 6-2 it is visible that the survey respondents highly emphasize the need for instructors to be actively involved in the discussion forum assisting students. Most of the students also consider themselves belonging within a virtual community of learners and feel that a productive discussion forum can be beneficial in achieving their learning goals (no. 2 & 6). Survey respondents consider the mobility of learning “any time anywhere” as an advantage (question 3, presented in Figure 6-2) and feel that the asynchronous nature of online discussion provide them with time to think and reflect on their learning better (question 4). There are some contradictions regarding the use of language in the forums; however most feel that limited use of informal language should be practiced during online discussion.

From Table 6-2, it appears that not everyone agrees (question 9, 10 and 11) with the criteria in the framework (Nandi, Chang & Balbo 2009) derived from blended learning environment. Approximately 30% respondents do not agree that students should use references to justify their opinions.



**Figure 6-1 Overview of the response for question 3, did you find that being able to post any time or anywhere as an advantage? (3=Neutral, 4=Agree, 5=Strongly Agree).**

Approximately 30% respondents do not agree that they should critically assess each other's posts. Investigating responses to question 15 indicates that around 30% respondents agree that the overall online environment hamper their efforts to understand and learn concepts in their courses. It is opposed by around 54% respondents who do not feel that the online environment hamper their efforts to understand and learn a specific concept in the subject

### ***6.3 Evaluation of Student Interaction Framework***

The survey responses to the open ended questions are analyzed to investigate what types of posts are valued as quality and productive participation by the students and instructors. Table 6-3 presents the themes that appear through data analysis along with the number of times they are mentioned by the respondents as valuable criteria for student participation.

Criteria		Number of times appeared in the survey response
<b>Asking Questions</b>		40
<b>Answering Questions</b>	<i>Straight and in detail</i>	39
	<i>With real world or coding example</i>	7
	<i>Justification</i>	8
<b>Clarification</b>		22
<b>Critical discussion of contribution</b>		5
<b>Ideas from interaction</b>		7
<b>Providing feedback</b>		2
<b>Sharing own experience and knowledge</b>		15
<b>Suggesting multiple solutions</b>		2
<b>Relevance</b>		31
<b>Consistency of participation</b>		5
<b>Informal Posts</b>		7

**Table 6-3: Themes derived from grounded theory relating to student participation and the number of times they appear in the survey responses.**

The themes presented above are discussed below along with actual quotes from the survey respondents.

### **6.3.1 Asking Questions**

Asking questions refers to queries regarding the course material or the management of the subject. We find that almost 70% of the survey respondents want to see questions being asked in the discussion forums which lead to productive discussion.

*<I get a lot from other students questions, as they ask questions sometimes that I haven't even thought of yet.>*

*<Questions relevant to the course and not advanced questions off topic>*

The survey respondents highly value this quality of asking questions and indicate that it is not only beneficial for the students who ask the questions but also for everyone else.

### **6.3.2 Answering Questions**

Answering questions refers to responding to the queries put up by the students or the instructors or providing solutions to the tutorial questions. Almost all of the survey respondents emphasize the value of answering questions which assists others to gain knowledge and inspire a productive discussion. We identify that, respondents' value in posting answers in different ways and we have classified them in the following three categories below.

#### **a) Straight and in detail**

This refers to answering questions in a straight forward manner. These questions might be asked by the instructors or posted by other students in the forum. They assist in sharing and reinforcing knowledge. Students value direct answers to tutorial questions as well as questions from other students.

*<Just simple help by answering questions that arise and just general discussion of the topic.>*



b) With real world or coding example

Providing examples while answering questions allows students to link the theory with real world practice. This criterion is also valued by the survey respondents.

*<A little more detail, ability to paste code so that it is formatted correctly.>*

c) Justification

Justification refers to providing clear rationalization for the posts while participating in online forums. It acts as a source of validation for a specific comment. Participants also highly value this quality in the survey and state that it allows other students to verify the accuracy of information.

*<Just gets a little confusing when incorrect information goes up.>*

*<I offer my thoughts and where i derived information from so they can check also.>*

### **6.3.3 Clarification**

Clarification refers to explaining the posts in a clear and concise way so the meaning can be easily understandable by everyone. This is one of the most important criteria for participating in any discussion forum. A lot of the survey respondents weighted this criterion very highly.

*<Most of my posts are queries for my information if I am not sure of the concept or do not understand it.>*

We find that a lot of the survey respondents weight this criterion very highly.

### 6.3.4 Critical Discussion of Contribution

Critical discussions of others' posts refer to agreeing or disagreeing with the posts and provide a logical explanation for that agreement or disagreement. This assists students to think critically and logically about the course topic in discussion. The survey respondents also consider this criterion as enabling quality interaction.

*<Usually if posting about a question, i give my thoughts to the answer and invite comment from others as to the validity of my answer, if giving an answer to someone else's question i offer my thoughts and where i derived information from so they can check also.>*

### 6.3.5 Ideas from Interaction

Ideas from interaction refer to when students learn some new concept from other students and use that knowledge to solve a certain problem or answer a question.

*<I get a lot from other students questions, as they ask questions sometimes that I haven't even thought of yet.>*

### 6.3.6 Providing Feedback

Providing feedback to each other is a criterion which shows students are freely assisting each other to develop knowledge.

*<Can complement, issue feedback, help, update, keep informed, share information, see how other students think and feel about a particular topic or discover something I didn't know to think about relating to....>*

### **6.3.7 Sharing Own Experience and Knowledge**

Sharing their own experience about solving a problem provides an assurance to others that certain IT or programming problems can be solved in that way. This is another criterion valued very highly by the survey respondents.

*<Want to see how others have approached the question or problem and solved it>*

### **6.3.8 Suggesting Multiple Solutions**

Suggesting multiple solutions for a single problem shows that the student has done some research regarding that problem. It also assists other students to consider different angles about certain problems or questions and in this way acquire more knowledge.

*<More than one solution makes me think in different dimensions.>*

### **6.3.9 Relevance**

Relevance in participation refers to posting comments which are directly or indirectly related to the subject of discussion. We find that almost all the survey respondents emphasizing the importance of having relevant discussion in the forum. Students want instructors to continuously monitor the discussion forum so that the participation is always based around the topic of discussion.

*<Students can maintain online discussion with no teacher intervention at all but I do not agree that this is a good thing all the time as some students can project an air of authority but be basically talking rubbish. >  
<Relevant to topic in question>*

### **6.3.10 Consistency of Participation**

Consistent participation keeps the discussion flowing and makes it vibrant. Survey respondents want to see consistency in participation with everyone posting on a regular basis. Also the term “consistency of posting” varies from subject to subject and depends on the instructors.

*<Where the students are actually contributing>  
<More participation. Especially from the tutors>*

### **6.3.11 Informal Posts**

This type of informal posts makes the discussion a bit “light hearted” which makes the forum more interesting. Being a part of a community of learners makes it easier for them to post some informal funny messages.

*<Subject topics and some light hearted stuff too.>*

## **6.4 Discussion**

Overall it appears that survey respondents favour the themes that allow them to gain, share, deepen and expand knowledge. A number of criteria in the area of cognitive skills and interaction quality (Henri, 1992; Newman, Webb & Cochrane 1996; Nandi, Chang & Balbo 2009), use of both formal and informal language

(Henri 1992; Gerbic, 2006; Nandi, Chang & Balbo 2009) and frequency of participation (Henri 1992; Nandi, Chang & Balbo 2009) are evident. Themes such as justification of posts, clarification of ideas, critical discussion of contribution, suggested multiple solutions are valued highly by the students.

The main emphasis is on asking and answering questions. Research done so far analysing themes for online participation, (Henri 1992; Newman, Webb & Cochrane 1996; Nandi, Chang & Balbo 2009; Garrison, Anderson & Archer 2001) largely focuses on how to answer questions and not on how the answers can be justified. Most of the themes provide a guideline on how quality responses should be posted in online forums. Students also highly value the importance of asking questions and how it triggers the quality of discussion. For quality discussion to take place, quality questions need to be asked.

The above discussion shows that the framework developed and described in Table 5-2 (Chapter 5) can be effectively utilized to design and assess student interaction in fully online courses. Almost all the criteria in the framework are highly valued by the students as found from data analysis. This framework provides a clear guideline for the students on how to effectively interact in fully online introductory IT/Computer Science courses. Instructors can use this framework as guideline to assess student interaction online.

## ***6.5 Evaluation of Instructor Contribution Framework***

The following table presents the themes that emerge from our data analysis and the number of times they appear in the survey responses. These themes provide an overview of the ideal role of the instructors (+tutors) in discussion forums.

Criteria	Number of times appeared in the survey
<b>Administrative guideline or technical assistance</b>	19
<b>Declaration of expectation</b>	2
<b>Periodic intervention to direct and extend discussion</b>	60
<b>Promoting deep learning</b>	5
<b>Providing direct answers</b>	17
<b>Providing feedback</b>	26
<b>Providing feedback with example</b>	2
<b>Importance of community building</b>	2

**Table 6-4: Themes related to instructor contribution and the number of times they appear in the survey responses.**

### **6.5.1 Administrative Guideline or Technical Assistance**

Administrative guideline refers to the rules and regulations of the course and the strategies that should be followed by the students. Administrative guidelines are regarded very highly by the participants. We find out that, respondents value this theme very highly as it provides the initial guiding principle for the whole course.

*<For the open forums just a regular reminder about the types of posts preferred and occasional purging of irrelevant material.>*

### **6.5.2 Declaration of Expectation**

It is important for the instructors to set expectations which assist the students to understand what the instructor wants out of them and act accordingly. It specifies what the students should be doing to achieve the ultimate goal of learning in

these courses. Although only twice mentioned in the survey, by investigating the number of times students ask questions related to the expectation of the instructors out of them in the course, this criterion should be valued highly and exercised regularly.

*<Make it really clear from day one exactly how things work (for that subject in particular), what is required and desired and how to make it work well for everyone.>*

*<Leadership, direction of requirements.>*

### **6.5.3 Periodic Intervention to Direct and Extend Discussion**

Extending of discussion refers to continuing the ongoing discussion by broadening focus while ensuring it does not get halted at a certain point. Consistent intervention by the instructor keeps the discussion always on track. Almost all the survey participants mentioned that they want consistent instructor intervention to direct the discussion. Specially, in a course like Introduction to IT, it is very easy to divert from the subject of discussion as diverse topics are covered in this course. Hence regular intervention assists students to stay on track.

*<Students can maintain online discussion with no teacher intervention at all but I do not agree that this is a good thing all the time as some students can project an air of authority but be basically talking rubbish.>*  
*<Periodic moderation is preferred.>*

#### 6.5.4 Promoting Deep Learning

It refers to not providing the answers directly and provoking the students' thinking process by providing certain helpful clues. Both instructors and students want deep learning to be promoted by the instructors.

*<Tips and advice about certain part of assignments, direction to information regarding your questions so you can check it out yourself.>*  
*<Hints and clues to find the answers to studies.>*

In order to do so, they want instructors to provide hints and clues to certain problems rather than the actual solution. This would allow students to explore and find out the correct solution themselves with the help of the hints.

#### 6.5.5 Providing Direct Answers

It assists students to learn what the solution of a problem is and verifies their own research. We have identified this theme as one of the main roles of the online instructors as mentioned by the participants. Students prefer instructors to provide direct answers to their questions which would verify their way of thinking about a certain problem.

*<I would like to see the instructors to be more proactive and to answer the questions clearly.>*



### **6.5.6 Providing Feedback**

Periodic and summarized feedback is regarded as one of the major roles of the instructors (Mazzolini & Maddison 2007). Feedback provides the students with overview regarding whether they are on the right track or not.

*<To supply expert information and correct incorrect information put forth by myself and other students.>*

A high number of participants want periodic instructor feedback. Respondents mention about this theme 26 times and highlight that it is important for the instructors to provide feedback on their work or comments, as it inspires them to work ahead or change direction while solving a problem.

### **6.5.7 Providing Feedback with Example**

Feedback with an example explains to the students in which way they should be concentrating on solving the problems. Examples provided by the instructors are probably considered as the most credible source of information by the students, such as sample code for a problem, or examples of how a network structure works.

*<Marking structure, where some useful information can be found i.e E-Books.>*

### **6.5.8 Importance of Community Building**

Community building refers to a group process which brings together individuals to go through certain stages that typify the formation of a cohesive group that has

established trust and a deep sense of connection. On campus students enjoy the benefits of easily establishing a group to study together. This idea of group work cannot be implemented as online students are much more isolated. Therefore a sense of virtual community is required so that students can feel free to interact with each other and share knowledge and ideas.

*<I want to feel myself within a virtual community of learners>*

## **6.6 Discussion**

Data analysis indicates that periodic feedback from the instructors is always valued highly by students which keep the discussion on track. Vonderwell, Liang and Alderman (2007) suggest that periodic feedback can encourage meaningful dialogue, increase collaboration, peer and self-evaluation and create a sense of community for a shared learning purpose. This result suggests that handing students the responsibility of directing discussion is not always the best option (Moller 1998) and instructors should be in control of the discussion at all times through an active presence. Students also want direct answers from instructors; however it falls to the instructor of the course to draw the balance between these two criteria of answering direct questions and providing clues or hints while moderating discussion.

Investigation of the data has shown that it is important to provide administrative or technical guidance early in fully online courses. Gulatee and Combes (2006) state that, computing students are at significant risk when attempting an online course compared to traditional classroom students because of the lack of interaction. Students need to know which software to install and guidance on how to install it. Hence clear and detailed guidelines are essential to assist the students to customise their fully online environment for learning. Instructors should declare early in the course their expectations of the students regarding

how to participate and acquire the best out of the discussion forum. This declaration may consist of directions regarding how many times and how often students should post in the discussion board, what should be the pattern of their contribution, how the students should approach the subject and in general what is expected of them. These findings emphasize the active involvement of the instructors in controlling learning processes (Vonderwell & Turner, 2005) which can help students in improving their ability to effectively use resources and strategies. The level of involvement can be different considering the different course content (Nandi et al., 2011).

From the above discussion we can comprehend that the framework developed and described in Table 5-4 (Chapter 5) can be extremely useful for designing and assessing instructor participation in fully online courses. Almost all the criteria were mentioned by the students during the survey. The pedagogical role of an instructor is valued highly by the students followed by the role of facilitator and managerial and instructional design. Hence this framework described in Table 5-4 can be used as an effective guideline for online instructors.

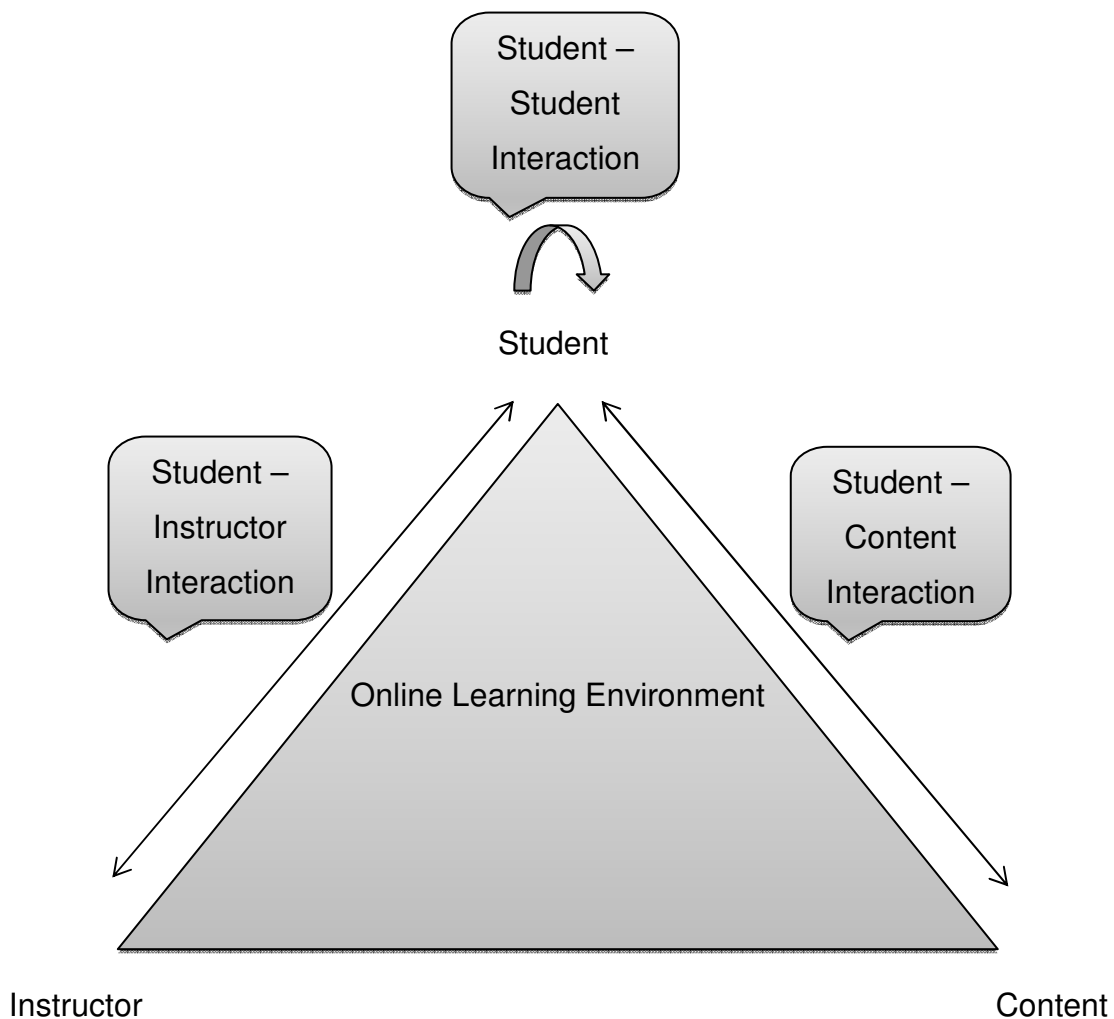
## **6.7 Summary**

In this chapter, Chapter 6, we evaluated the frameworks that we developed in Chapter 5. These two frameworks provide clear guidelines on how to design and measure student interaction and instructor participation in fully online introductory computing courses.

The next chapter, Chapter 7 explains the last stage of our research where we investigate student – content interaction and the strategies for effective content management for fully online introductory computing courses.

## Chapter 7 - Student – Content Interaction

The final stage of our research is described in this chapter where we examine the third type of interaction as defined by Moore (1993) and Clayton (2004), student – content interaction. In the prior stages, we developed and evaluated the frameworks for effective student – student interaction and instructor contribution.



**Figure 7-1 Types of interaction in fully online courses (Moore 1993, Clayton 2004).**

The research question addressed by this stage of the research is:

*What factors need to be considered for designing effective student – content interaction in fully online courses?*

The research design for stage has been described in Chapter 3, Section 3.6.4. The detailed data analysis and findings are discussed in the following sections.

## **7.1 Overview of the Survey Respondents**

As mentioned in Chapter 3, we designed a survey questionnaire (Appendix B) to investigate the student – content interaction. A total of 73 students responded to the survey with 46 from the Introduction to IT course (IT5) and 27 from the Introduction to Programming course (Prog5). There were 250 students enrolled in the IT5 course and 180 in the Prog5 course.

Course	First Time Online		Study Level		Age Level			
	Yes	No	Undergrad	Postgrad	18-30	30-40	40-50	50+
Introduction to IT (IT5)	38	8	43	3	32	11	2	1
Introduction to Programming (Prog5)	18	9	27	0	17	4	4	2

**Table 7-1: Overview of the survey respondents.**

Our research shows that around 50-60% students never use the learning management system and hence not active at all in the discussion forums (Chapter 4) making the effective survey response rate around 38% and 30% respectively for the IT5 course and Prog5 course which can be considered above

average for fully online students (Sax, Gilmartin & Bryant 2003). Again this number of 73 is well above the suggested sample size of 20-50 for a grounded theoretic approach (Mason 2010; Creswell 1998 (p.64); Morse 1994 (p.225)).

From the table (Table 7-1) we can see that, most of the students are undergraduates aged between 18 and 30. As expected, these are the first fully online courses they have ever been enrolled into. Approximately 25 out of 27 respondents used the online learning management system regularly throughout the Prog5 course; whereas this number is 35 out of 46 respondents in the IT5 course.

## ***7.2 Themes Emergent from Data Analysis***

Table 7-2 presents the themes that emerge from applying open, axial and selective coding to the survey responses. The number of times each theme appears from both IT5 and Prog5 courses has been charted. We derived eight main themes through data analyses which are considered as most important to ensure effective student – content interaction in these fully online courses.

We have identified the flaws pointed out by the survey respondents in the current content management system and also suggested ways through which effective student – content interaction can be ensured. Along with pointing out the flaws, students also place their suggestions on how both content and content area should be managed. Through the analysis of flaws and suggestions put forward by the students, we identify a set of criteria and guidelines to ensure effective student – content interaction in fully only online courses.

Theme		Number of times appeared in the survey (IT5)	Number of times appeared in the survey (Prog5)
Structure	<i>Organization</i>	23	21
	<i>Usability</i>	35	24
	<i>Navigation</i>	21	24
	<i>Information</i>	4	4
Course Management	<i>Early Release</i>	30	7
	<i>Periodic Release</i>	15	11
Content Areas Accessed	<i>Assignment Forums</i>	14	14
	<i>General Forums</i>	3	8
	<i>Group Forums</i>	7	4
Content Areas Posted	<i>Assignment Forums</i>	6	4
	<i>General Forums</i>	8	12
	<i>Group Forums</i>	4	1
Preferred way of Communication	<i>Synchronous</i>	21	5
	<i>Asynchronous</i>	15	13
Type of Preferred Book	<i>E-Books</i>	15	11
	<i>Paper Books</i>	5	2
Community Building		18	15
Task Distribution		17	10

**Table 7-2: Themes emergent from the survey (Appendix B).**

The findings from the survey analysis i.e. the themes and sub-themes along with quotes from the survey respondents are presented below.

### 7.2.1 Structure

Almost all the survey respondents emphasize the importance of proper content management structure. As fully online students, poorly structured content management creates confusion which causes and creates unsatisfactory learning experience.

We have divided this theme into four categories; they are Organization, Usability, Navigation and Information. These sub-themes are discussed below.

#### a) Organization

Organization of the content is termed as one of the most important factors in ensuring that students can have a smooth interaction with the content. This criterion is mentioned 23 and 21 times respectively in IT5 and Prog5. Most of the students feel that the current method of content organization is old, antiquated and should be revolutionized to make it more contemporary. They feel that current organization method makes it complicated and as a result creates a bar into their efforts to learn.

*<It doesn't look or feel as simple and clean as the modern interfaces we've all come to appreciate, such as those of Facebook etc. > [IT5]*

*<Areas are well organized. > [Prog5]*

*<I feel that the interface is over complicate. > [IT5]*

*< Not structured as well. > [Prog5]*

Students suggest that organization of the content should be modernized and hence the examples from the social networking sites can be followed. Discussion



threads should be properly managed and restricted to week by week and topic by topic. There should only be as many threads as required and should be organized in such a way that newly created threads or newly posted messages are easy to find.

*< I think some items within these links could also be amalgamated into other sections to reduce the overall number of links in the main menu. > [IT5]*

*< They should be kept current and relevant to ongoing discussions with week to week specific threads created. > [IT5]*

*< All discussions on all topics should be in one spot. > [Prog5]*

*< They should be dated from newest to oldest rather than vice versa, and some customizability. > [IT5]*

Students mention that initially in the first few weeks of the courses, it is manageable to access the content through the current structure. However, after a few weeks into the course with huge numbers of new threads being created and new messages being posted, it gets challenging for the students. Following the above mentioned steps should make it easier for the students to access and use the content throughout the courses.

#### b) Usability

Usability of the system to access the content is considered as the most important criteria for student – content interaction. Almost 35 times in the IT5 course and around 24 times in the Prog5 course, students mention about this criteria in their responses. Students feel that the current system is not user friendly for accessing content and is one of the main reasons for their learning dissatisfaction. Students had to struggle to cope with the system to access

almost every bit of content in the courses. This phenomenon of dissatisfaction is evident with all the IT5 students, while few of the Prog5 students found the system to be user friendly.

*< But too many clicks to get to where you want to go. > [IT5]*

*< When I sort by date so that the most recent posts are at the top (as most forums are by default), it never remembers my preference. > [IT5]*

*< Sometimes you want to find something that you read earlier and it takes a long time to find it again. > [IT5]*

*< Very user friendly. > [Prog5]*

*< I still believe BB to be a cumbersome and non-user friendly experience on the most part. > [IT5]*

*< At one stage I did find it hard to work out how to reply to an existing thread. > [IT5]*

Students suggest some features to improve the usability which are again mainly influenced by the social networking sites. Suggestions include using thread subscription, adding features such as notifications when their queries have responses, less numbers of threads, easier way to create and respond to enquiries in threads and flexible ways to download content.

*< Simple features such as thread subscription / notifications would be very handing in a learning based discussion board. > [IT5]*

*< Upgrade the forum to one that is user friendly. > [Prog5]*

Adding the above mentioned features would make the system more users friendly and hence students will be able to access content with less difficulty.

### c) Navigation

Navigation refers to browsing through the learning management system in order to access the different content in the courses. Survey respondents point out to this criterion as very important while designing student - content interaction and is mentioned on 21 instances by IT5 students and 24 instances by Prog5 students. Students feel that the navigation through the system to access content is not easy to handle and hence they struggle to browse through content. Students mainly browse through the different threads and downloaded recorded tutorial sessions and offline study material. It takes time for them to become familiar with the system because of the distribution of links and tabs within the environment.

*< I didn't understand where things were located. > [Prog5]*

*< Time consuming searching for information as you have to open each thread individually. > [Prog5]*

*< Generally good when the navigation is understood. > [Prog5]*

*< At first it was hard to work out what the tabs at the side did, and how they provided different functions and information. > [IT5]*

*< Navigate to download the offline content to watch the lectures and read worksheets etc. > [Prog5]*

Students suggest that few links can merged together to improve the distribution of links and tabs within the environment. An overhaul of the system is suggested

with less number of links and tabs to browse through which should improve the navigation experience of the students.

*< I think some items within these links could also be amalgamated into other sections to reduce the overall number of links in the main menu. > [IT5]*

*< Might be a little better if the recent posts come to the front, rather than navigating through the pages to find them. > [IT5]*

*< It needs a much better laid out page map to be able to move quickly and efficiently throughout the site. > [IT5]*

#### d) Information

Students mention that there is lack of information regarding the use of different links, tabs and threads to access the content. Because of the lack of proper information, it takes a while for the students to access the content. We find out this criterion mentioned 4 times by students from both the courses. There are two types of information termed as important by the students; one is related to how to solve assignments such as what are the different criteria to solve in the assignment, how to handle specific issues, which concept to use and which not to and how to submit solved assignments. The other is related to navigation such as which link does what, what information can be found under what tab and how to find out about course administrative issues.

*< Assignment threads are good for additional information, but it can get very crowded and important information can, and is, missed. > [IP5]*

*< Information was not always easy to access. > [IT5]*

*< At first it was hard to work out what the tabs at the side did, and how they provided different functions and information. > [IT5]*

*< The information in the unit seems to be lacking. > [Prog5]*

Students suggest that more clearly customized information is required for a better learning experience. Threads can be marked up with information about their functionality and separate tutorial sessions can be arranged to provide students information about navigating and accessing the content by the instructors.

*< It couldn't hurt to have more information. > [Prog5]*

*< There could be a mandatory tutorial for new students on how to use (ie. what is WebLearn and its functionality, what is the Blackboard and its functionality). > [IT5]*

*< There are better systems out there that do this already; they have a list of discussion boards on their forum with a description of each one underneath (eg. vBulletin). > [Prog5]*

*< Perhaps a separate page describing each of the main threads, their purpose and scope of discussion. > [Prog5]*

Administrative guidelines and information should be placed in separate threads and pointed out clearly so that students can access it easily throughout the duration of the courses. As fully online students, their only media of accessing information is via the learning management system; hence a proper management of significant information should be provided to them in a structured manner.

## 7.2.2 Course Management

The issue of how the courses are managed has a strong impact on student – content interaction. The main two factors that impact course management are the assessment and course notes and when to release them. We find that around 65% of the survey respondents in the IT5 course voting for early release whereas this number is only 26% for the Prog5 students. Most Prog5 students (around 41%) want the assignments to be released periodically and not early. These differences are discussed below.

### a) Assessment

Most of IT5 students (65%) and few Prog5 students (26%) feel that assignments should be released early in the course altogether. Students feel that releasing the assignments early provides them with the opportunity to start working with them from the very beginning. It gives them enough time to plan their workload ahead as most of the fully online students have full time work and family commitments to take care.

*< They should be released straight away so students can get straight into them. > [IT5]*

*< As long as the dates are given early to when they will be released and when they are due. > [IT5]*

*< Some people like to work ahead of other students and if the assignments aren't released early enough they cannot do this. > [IT5]*

*< It's much easier for those with commitments, to adjust to their workloads, if we already have it on hand. > [Prog5]*

Conversely most of the Prog5 students (41%) feel than assignments should be released periodically. It allows them to learn the concepts first and then attempt the assignments. It also prevents them from rushing to assignments before going through the study material and has better understanding of what is expected in the assignment.

*< Periodically because there is always the temptation to rush in and complete assignments early before key concepts have been properly learnt. > [IT5]*

*< It's important to encourage the study of all the key concepts before allowing the attempting of any related assignments. > [IT5]*

*< Periodically because I would have felt intimidated by the presence of all the assignments which I would not have understood. > [Prog5]*

*< Periodically - easier to understand what can/can't be used in an assignment. > [Prog5]*

Rest of the students do not have a specific preference regarding the schedule of assignment releases as long as enough time is provided to complete and submit them.

#### b) Course Notes

It is unanimously agreed that all course notes should be released altogether early in the course. This would allow students to self-pace their study and plan for the semester well in advance along with their work and family commitments.

However, clear directions are expected from the instructors on what to cover in which week and when assessments are due to handed.

*< Course notes, and in fact, all course materials (assignments included) to be released early. > [IT5]*

*< You should release the course notes early and let students self-pace however course notes should be well structured so that there are not too many concepts per week and students can easily divide the content up. > [IT5]*

*< Early release of all course notes is better; this would help some students to plan study better. > [Prog5]*

No survey respondent is in favour of periodical release of course material.

### **7.2.3 Areas Accessed**

We find from the data analysis that, the mostly accessed content areas are the assignment forums in both the courses. Almost 30% students in the IT5 course and 52% in the Prog5 course respond that they mainly access the assignment forums as assignment related questions are discussed there. It allows them to clarify the requirements for the assignments and get directions on solving the problems.

*< I need it to access assignments and online tests. > [IT5]*

*< It's always good to know when other people misinterpret things too - like me! :) > [IT5]*

Only 7% students in the IT5 course and 30% in the Prog5 course mainly access the general discussion forums. Reasons for accessing these forums include; able



to discuss with all the students in the course, greater student participation in these forums and able to discuss general concepts and queries.

*< General, as there was always some helpful and general information being discussed about for eg. Alice problems, bugs/errors, questions about exercises etc. > [Prog5]*

Around 15% students in both the courses access the group discussion forums regularly. These forums allow them to discuss weekly study materials within a small group and the tutors.

*< My study group forum, because this is where my tutor posts and where some tutorial discussions take place. > [IT5]*

This analysis provides us with a clear view about content areas that are most accessed by students and the reasons for doing so.

#### **7.2.4 Areas Posted**

Unlike assignment forums which see most number of accesses, general discussion forum is the one that sees most number of posts from the students. Around 17% students in the IT5 course and 44% in the Prog5 course respond that they prefer to participate and post mostly in the general discussion forum and it is accessible by all the students in the courses. Hence questions are responded to quickly and directly unlike the assignment forums, where direct answers are not permitted.

*< The general, more people to get more opinions from. > [IT5]*

*< The General discussion forum as I got answers quickly. > [Prog5]*

Around 13% and 15% students in the IT5 and the Prog5 course respectively think that posting in the assignment forums are more advantageous. It allows them to ask questions about assignment criteria and guidelines.

*< Assignment forum, Great to be able to ask questions regarding the assignments and get feedback from other students and tutors. > [IT5]*

*< Assignment forum to help other students. > [Prog5]*

We find very few students in both courses mentioning that they post in the group forum to discuss weekly study materials. These forums are created to discuss in small groups and are not popular with the students.

*< Our tutor's forum as it discusses weekly material. > [IT5]*

### **7.2.5 Preferred Way of Communication**

Prog5 students (48%) mostly prefer to use asynchronous communication for interaction while learning the content. This number is around 33% for IT5 students. Students mention that asynchronous communications allow them time before asking and responding to questions and have better student participation.

*< General forums are great because there are more people to provide questions/answers and I don't need to go hunting on different boards for answers. > [Prog5]*

*< I can however see the benefit of having a general discussion area where all students for the particular unit can contribute. > [IT5]*

*< General as it covers a broader selection of questions. > [Prog5]*

On the contrary, more IT5 students (46%) than Prog5 students (19%) prefer to use synchronous communication. The benefits included; instant question and answer through text chat and problem solving through audio and video demonstration.

*< Mostly used Elluminate, and not forums. > [IT5]*

*< Elluminate, as it's a more interactive discussion medium, with instant answers. > [IT5]*

*< Elluminate, this was really helpful because our tutor helps you to understand it not only by discussing the work but also by showing examples e.g. how to do binary notation. > [IT5]*

Rest of the students do not have a specific choice of communication media. Students also suggest that smaller groups should be made for synchronous communication sessions as it gets crowded and all queries cannot be responded to among the confusion.

*< I do think they need to be either smaller group of longer "Elluminate" sessions as with the amount of students in the group one hour isn't long enough for every student to ask all their questions. > [IT5]*

## **7.2.6 Community Building**

The sense of a virtual community of learners can assist students to freely access and discuss the content. As mentioned previously, the "Welcome and Introduction" threads were specifically created to "introduce" students to each

other. Small groups were also created to allow students to communicate better. Analysing the survey responses, we can see these approaches are not good enough to build a community of learners. As we find from the survey responses, most of the students feel that the system is not personalized enough to be able to find themselves within a learning community. Students also mention that the “Welcome and Introduction” threads are set up in the wrong place as it gets overwhelmed with introductions only and no communication. The group formation is another problem as identified from data analysis.

*< Having segregated study groups from the beginning, the problem I found with having the welcome and introduction threads in the general discussion forum here was the overwhelming number of posts. > [IT5]*

*< It's hard to make friends online I think. > [IT5]*

*< People just posted individual introductions; I did not read many introductions at all as there were too many. > [IT5]*

*< It's not personalised enough. > [Prog5]*

*< Love introducing myself on the welcome thread, love meeting new people and it's in this thread that i am always in future going to try and get a skype group going straight away, so many people jumped on board i can see the benefits involved. > [IT5]*

*< In fact that they introduce them self's but after that there's no discussion. > [Prog5]*

Students suggest that smaller groups should consist of students from the same geographical location as it would allow them to meet and discuss their studies physically. The “Welcome and Introduction” threads should also set up within

groups and allow students to post more details such as hobbies and careers which would encourage more interaction among similar type of students. Overall a more personalized system is suggested to build a better community of learners.

*< I think the groups should be chosen by location rather than alphabetically though. > [IT5]*

*< Smaller groups would help a little. > [IT5]*

*< Make a more personalised experience and more interaction from Tutors plus encourage (give a reason for) interaction between students. > [Prog5]*

*< Maybe there should be a hobbies and projects section so people can show what they are doing outside of university maybe. > [IT5]*

*< I think that putting people into small study groups of 10 or so would create a better community. > [Prog5]*

### **7.2.7 Task Distribution and Facilitation**

The way course content and content areas are handled has an impact on student – content interaction. As mentioned previously, specific task are assigned for the instructor and tutors throughout the courses. Around 37% students in both courses find this theme very important for course and content management. Students feel that confusions occur about the course and assessment content and which area is handled by the instructor and which by tutors. This situation causes them to provide confusing and contradictory opinions.

*< I have found it incredibly frustrating that people are walking on eggshells giving advice on assignment 1 but not being able to simply tell us what to do. > [Prog5]*

*< Most questions about the assignment come from a misunderstanding of the learning material by the student. > [Prog5]*

*< The less guesswork students have to do, the better. > [IT5]*

*< Course content i.e. assignments could be worded a bit better as it was hard to understand what was wanted. > [IT5]*

Students suggest that the course and content management system should be made simpler for better interaction. Tasks should be divided clearly and the information should be readily available to the students regarding who to contact for information about specific content and content area.

*< It's beneficial within a tutorial but sometimes it's good to have a tutor give a quick 15-30min overview of the week's content beforehand. > [IT5]*

*< Assignment queries they should be handled by whoever is marking the assignment. > [IT5]*

*< I suppose clarification should be handled by one person to avoid confusion. > [Prog5]*

*< I think it should be better clarified what we need to take in and learn and what is auxiliary learning. > [Prog5]*

### 7.2.8 Type of Preferred Books

E-books are the preferred type of books for students in both courses. We find that around 33% of the students in the IT5 course and 41% in the Prog5 course want e-books to be available for these courses. They mention that it is easier to acquire these books online and provide them with the facility of portability as it can be loaded in a portable device and read even while they travel. Some students feel that it perfectly suits the fully online educational model in which they are involved and would be economical to acquire them.

*< Yes, less hassle getting them. > [IT5]*

*< E-Books are a very powerful learning tool, particularly for the people that are actively using blackboard. > [IT5]*

*< It is a logical progression for this education model. > [IT5]*

*< Yes, if it is cheaper and just has the information required per chapter. > [Prog5]*

Alternatively around 11% in the IT5 course and 6% in the Prog5 course still prefer to use the traditional paper books for their studies. It suits students who do not use portable devices.

*< Still prefer my printed copy as I don't have a portable e-Reader device. > [IT5]*

*< Ipad is great for quick referencing but Paper books are still essential. > [Prog5]*

These findings provide an idea for the administrators regarding what type of books are preferred by the fully online students and why and hence they can act accordingly.

### **7.3 Discussion**

The key focus of this research has been around investigating the criteria that are essential in setting up effective student – content interaction. By analysing the survey responses, we have uncovered several themes that can act as a base for designing and managing content in fully online courses to ensure that students can have proper and flexible interaction with the content.

Through data analysis, we have discovered that the most important criterion for effective student – content interaction is the structure of the content management system. Designing an appropriately structured content management system can provide the students with the opportunity to browse and interact with the content of the courses at any time. The four sub-themes that emerge from data analysis under the main theme structure are: Organization, Usability, Navigation and Information. These four sub-themes need to be looked at when managing content in fully online courses. A simple organizational content management structure which is effortlessly useable by the students, easy to browse through the online content and contains a substantial amount of information about the learning system should ensure effective student – content interaction for fully online students.

Students point out that the current content organization is confusing; the system is not user friendly; it is not easy to navigate through content and not enough information is provided. Chen, Pedersen and Murphy (2011) explained that academic webpages containing more than three levels confuses students and



our students prefer a linear as opposed to a non-linear style for browsing web pages.

Students suggested that the content management system should be more personalized and simpler. This could mean fewer threads could be created making management easier. Also a subscription facility could be added and notifications should be provided. There should be information about which link and tabs provide what functionality. The design patterns of the social networking sites such as Facebook are mentioned as examples of worthy structures in particular the Facebook notifications facility are highly praised. Integrating the design patterns from such social networking sites into learning and content management system could be beneficial to students. The inclusion of the design and social approaches of the freely available social networking sites and web 2.0 technologies to science education have positive impact on learning (Badge, Saunders & Cann 2012; Gray et al. 2012).

All these features mentioned above should make the system more flexible to use and more personalized. Brusilovsky (2004) also identified this issue of personalization and flexibility with the students from varying diversity in terms of location, age, background participating in these fully online courses. Following the above mentioned guidelines should provide the students with an adaptable learning experience based on their individual learning skills which is critical for success in fully online courses (Darbhamulla & Lawhead 2004).

The timing of assignment and course note release impacts student interaction with the content. Research done so far has indicated that course notes should be released early in the course whereas assignments should be released periodically (Chapter 4). Releasing assignments early creates a sense of panic in the students and they attempt to overcome it by concentrating on the assignments first rather than going through course content. We have identified contradictory opinions among students about the timing of assignment releases.

Most of the IT5 students prefer to have the assignment released early. The argument in favour of this arrangement is that it allows fully online students with work and family commitments to plan their study requirements ahead. Conversely, more Prog5 students want the assignments to be released periodically as it would provide them with the opportunity to learn the concepts more thoroughly before attempting the assignments. As learners with different preferences interact with content in different ways (Wilson & Albion 2009), educators should take into consideration the course content and student cohort before implementing their strategy for assignments. All the survey respondents anonymously agree that all course notes should be uploaded in the learning management system early during the first week of the course. This was a practice in both the Prog5 and IT5 courses that we investigated. This approach of releasing course notes early is different from most of the on-campus courses where course notes are normally released weekly. Again the argument is that most of the online students have fulltime study and family commitments and hence study at different speeds.

Crampton, Ragusa and Cavanagh (2012) suggest that academic performance of the students is influenced by the number of accesses and posts. Through this research, we have investigated which content area within the learning management system are accessed and participated mostly by the students and why. Students mostly access the assignment forum to find information, clarifications and hints about assignments. We have identified this phenomenon in both groups of students. Conversely, students mostly post in the general discussion forums which are accessible to all the students. It indicates that students like to participate in forums which are populated and vibrantly participated. The issue of task distribution among instructors and tutors is also dependent on this issue of access and participation as educators need to decide on which areas should be handled by the instructors and which areas by the tutors (Nandi, Hamilton & Harland 2012). The group discussion forums are accessed and participated in by lowest number of students where weekly study

materials are discussed. This shows students have goal based learning strategy where they concentrate more on assignments rather than learning and discussing the study material first.

There are contradictory opinions among students regarding the choice for the preferred method of communication. Most IT5 students (46%) prefer synchronous communication whereas Prog5 students are in favour of asynchronous method (48%). The difference of opinion can be explained by the difference in course content (Nandi et al. 2011). IT5 students can get more benefits from synchronous communications as general information technology related topics can be discussed and straightforward answers to queries can be provided. However, in case of the Prog5 course, systematic and logical explanation is required to respond to and analyse codes and it requires more time and thought. Hence programming students benefit more from synchronous communication where they can get time to think and analyse.

The last two themes are mostly agreed upon that e-books should be provided which suits the fully online mode of instruction and a learning community is important in achieving the success. Benefits for e-books include: easily accessible, can be loaded into portable devices and hence remotely available. As a result students can have greater control over when and where learning takes place in the midst of work and family commitments (Nie et al. 2011). Different suggestions were provided by the students on how to develop a virtual community of learners. The “Welcome and Introduction” or similar threads should be set up within groups which allows communication to be within small number of students. Hence it becomes easier for students to interact freely with other and participate in discussion of the content in different content areas.

## **7.4 Summary**

We have investigated the factors that impact student – content interaction in fully online courses. Due to exploratory nature of the research, the major focus has been to identify key sets of criteria which need to be taken into account for effective content management. A number of key themes have emerged and we have developed overall guidelines according to the preference of fully online students.

Results of our data analysis show that there are eight criteria that need to be taken into account by the educators. They are: structure, course management, content areas frequently accessed, content areas frequently participated, preferred method for interaction, type of preferred book, community building and task distribution. It emerged from data analysis that properly organized structure, a usable system, clear and flexible navigation and adequate information about the content management assists students in effectively interacting with the online content. We have incorporated a number of measures from student evaluation to improve the overall structure of the content management system.

Data analysis also reveals the preference of the students in regards to timing of assignment releases, method of communication, type of books and also the reasons behind such predilection. Our research has derived the set of criteria for designing effective content management strategies. The applicability of each criterion may defer depending on the course content and student cohort as we found out that, students from different courses has different opinions over few of the criteria.

Within Chapter 7, we have investigated the different factors associated with student – content interaction. We analysed the responses to the surveys and focused on the flaws identified by the students in the current content management system as well as analysing their suggestions about how it can be

improved. Based on our data analysis, we identified several criteria which should be carefully considered while setting up and managing content in fully online courses to ensure effective student – content interaction.

# Chapter 8 - Conclusion and Future Research

## ***8.1 Findings and Contribution***

The overall research question that we have investigated in this research is:

*How can we develop design principles for quality online interaction in fully online computing courses?*

The specific questions are:

- 1. What are the important factors that affect student activity in fully online courses?*
- 2. How can we evaluate quality interaction between students in fully online courses?*
- 3. How can we define the appropriate criteria for the instructor to interact with the students in fully online courses?*
- 4. What factors needs to be considered for designing effective student – content interaction in fully online courses?*

As explained in Chapter 3, Methodology, we conducted our research in four key stages to address the research questions and our results and key findings are summarized below.

## ***8.2 Stage 1: Analysis of Student Activity and Achievement***

The focus of Stage 1 of our research was to investigate the specific research question 1.

We approached this stage of our research in two phases as explained in Chapter 4. In the first phase, we measured how active students are in online discussion forums and the correlation between their activity and their overall marks obtained in the subject. This phase provided a general overview of the activity of students in the online discussion forums in two introductory courses in a fully online learning environment.

We identified that a high percentage of students (around 60%) do not access the discussion forums and do not post at all throughout the semester. Final results show that it is vital for students to participate consistently to achieve a high grade (Nandi et al. 2011) as discussed in Chapter 4 (Figure 4-7 and 4-8). We also identified several underlying factors in this phase that contribute towards students' active participation online such as course management and student expectations.

In the second phase in Chapter 4, we investigated what factors of the online environment or course management impact on student participation and achievement. We identify and explain how student activity differs from period to period in reaction to the changes made in course management and the impact of assessment on student participation and achievement. There were high dropout rates in all the online courses (Figure 4-18 and 4-19); however most of the students who continued in the courses achieved excellent results. One of the key lessons learned from this research stage is that mostly quality and not quantity of moderation by the instructors and tutors affects the student participation.

### ***8.3 Stage 2: Framework Development***

The focus of Stage 2 of our research was to investigate the specific research questions 2 and 3.

We investigated the quality of online discussion by analyzing the discussion forum participation. Through data analysis, we modified the framework for quality student – student interaction and proposed in Chapter 2 and developed a new framework for instructor contribution (Nandi, Hamilton & Harland 2012). We identify that students are actively participating in the discussion by asking and answering questions as criteria which are highly valued and exercised by the students. In response, instructors post both direct answers and hints to promote deeper learning depending on the content. Instructors also actively attempt to extend discussion and raise new questions in the IT course and provide detailed feedback with examples which is relevant to the course content. We also identify that rather than designing a purely student-centered or instructor-centered discussion, a combination of both the approaches is preferred. This requires both the students and instructors to take responsibility to construct and share knowledge and ideas. Students can have guidance on what is expected of them through our framework in Table 5-2, while Instructors and tutors can design their role and workload through the framework in Table 5-4. The themes and frameworks presented in Chapter 5 provide clear guidelines that can be used as design principles for developing and supporting quality discussion forums in fully online courses.

#### ***8.4 Stage 3: Framework Evaluation***

The focus of Stage 3 of our research was to evaluate the frameworks for student – student interaction and instructor contribution developed in Stage 2. In order to evaluate the frameworks, we designed and conducted surveys which contained both closed and open-ended questions. Through these surveys, we verified the set of criteria in both the frameworks and the relative importance of each of the criteria according to the students. According to the survey response analysis, the frameworks were modified in this stage. We identified that the framework



developed and described in Table 5-2 can be effectively utilized to design and assess student interaction in fully online courses. All the criteria in the framework are highly valued by the students as found from data analysis. This framework also provides clear guidelines for students on how to effectively interact in fully online computing courses. Instructors can use this framework as a guideline to assess student interaction online.

The framework developed and described in Table 5-4 can be extremely useful for designing and assessing instructor participation in fully online courses. All the criteria were considered important by the students during the survey. The pedagogical role of an instructor is valued most highly by the students followed by role of facilitator, managerial and instructional design. Hence the framework can be used as an effective guideline by the online instructors.

### ***8.5 Stage 4: Student – Content Interaction***

The focus of Stage 4 of our research was to investigate student – content interaction by addressing the specific research question 4.

The intention was to identify the criteria that are essential in setting up effective student – content interaction. We designed and conducted surveys. Through the analysis of the responses, we revealed several themes that can act as a base for designing and managing content in fully online courses to ensure that students can have proper and flexible interaction with the content. We have identified eight criteria for effective content management that need to be taken into account by the educators. They are:

- Structure
- Course management
- Content areas frequently accessed
- Content areas frequently participated

- Preferred method for interaction
- Type of preferred book
- Community building
- Task distribution

The applicability of each criterion depends on the course content and student cohort as we find out students from different courses has difference in opinions over some of the criteria.

## ***8.6 Suggestions for Future Work***

There are many areas of future investigation suggested by our research results. The set of criteria and frameworks can be applied in online courses over multiple semesters to investigate patterns over time. As LaPointe & Gunawardena (2004) pointed out, many variables can potentially influence peer interaction and learning outcome. Hence an investigation of all the influential variables affecting interaction can be undertaken.

Future research could be undertaken to identify the implications of the frameworks developed in this research in different higher education contexts with different online courses. This research would provide more insights into how students and instructors interact to learn and develop in online courses in different context. A comparison can also be carried out showing what a good quality discussion and a poor quality discussion is with illustrated examples to investigate and highlight the fundamental differences between them.

Our research only looked at the student participation in a tertiary learning environment, specifically in undergraduate courses. Future research would benefit by adapting the framework in postgraduate courses with large student cohort and multiple tutors. Professionals are also enrolled in online training courses and research in this field could prove to be valuable in future. The effects

of the frameworks on design and structure of online activities and role distribution could benefit from future research. The applicability of the set of criteria can also be investigated into online professional training courses and the difference could be analysed. Future research can benefit by applying these set of criteria for student – content interaction into different online courses from diverse disciplines and investigating the implications.

The usability of technology was an interesting area raised by the participants. One of the major features of the online environment is the usability of the technology and human computer interaction. An investigation into the future of the technology for online learning and how technology affects participation and human computer interaction within an online environment could prove to be an interesting topic for research.

Our research has addressed a significant issue of online learning, interaction. We have developed design principles for supporting quality interaction in fully online computing courses and created opportunities for future research to increase the knowledge base regarding the role of students and instructors to enhance learning. The findings of our research directly support educational institutions with valuable information and thereby improve the quality of learning in fully online courses.

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# Appendices

## ***Appendix A: Survey Questionnaire for Framework Evaluation***

- 1) Is your first language English?
- 2) Is this the first course where you are participating in online forums?
- 3) Are you a postgraduate student or undergraduate student?
- 4) What is your age level? I.e. within 20-30 or 30-40 or 40-50 or 50-60?
- 5) Please answer the following questions by indicating the number that most closely corresponds with your judgments for each of the criteria statements regarding the use of online forums. Please write your answer in the “Ans” Column. Strongly Disagree = 1, Disagree = 2, Neutral = 3, Agree = 4, Strongly Agree = 5.

	Criteria Statements	Ans
1.	The setting and structure of the online discussion forum was easy to follow initially	
2.	During the use of the online discussion forum do you consider that you are part of a community of learners	
3.	Did you find that being able to post any time or anywhere as an advantage	
4.	Do you feel the online discussion forum gave you more time to reflect on what you wanted to ask/answer allowing you to process your ideas better	
5.	Do you prefer working in a team to collaborate rather than an individualistic approach, working on your own	
6.	The online discussion forum has been useful for learning and understanding of concepts or a subject	

7.	Do you feel it is an advantage if all students participate equality and consistently	
8.	Do you feel students should raise new issues/directions about the topic of discussion in the forum	
9.	Do you feel students should justify their opinions through proper references	
10.	Do you feel students should bring in outside knowledge as example while discussing about a topic	
11.	Do you feel students should critically assess each other's posts	
12.	Do you feel students should use informal language or social cues sometimes to lighten the discussion	
13.	Do you feel instructors/tutors should be actively involved in the discussion	
14.	Do you want instructors/tutors to answer your questions rather than students	
15.	Do/did you ever feel that this online environment hampered your efforts to understand/learn a specific concept in the subject	
16.	Do you feel that you are learning the necessary skill of problem solving through this online environment	

- 6) Do you believe that discussions need moderation or do you think students can maintain online discussion with no teacher intervention at all?
- 7) Think about the way you post online in discussion forums. Write a few words, describing the patterns of your posting?
- 8) Do you think that a face-to-face environment is better for learning programming /IT courses? Why/Why not?
- 9) Discuss the kind of posts you want to see from other students.
- 10) Describe the role of the instructors you want to see in online forums.
- 11) Can you name a specific concept that you found difficult in the subject? Do you think you found it difficult because the subject is online? Why/Why not?

- 12)What are the most important changes that you have observed in your personal learning practice after the participation in the discussion forum?
- 13)What type of posts in the forum according to you can be termed as productive for you and other students?
- 14)Do you have any suggestions regarding the future structure of online discussion forums or the online courses?

## ***Appendix B: Survey Questionnaire for Student – Content***

### ***Interaction***

- 1) Is this the first course where you are participating in online forums?
- 2) Are you a postgraduate student or undergraduate student?
- 3) What is your age level? I.e. within 18-30 or 30-40 or 40-50 or 50+?
- 4) Was the setting and structure of the online learning management system (Blackboard) easy to follow? Why/Why not?
- 5) Do/Did you regularly use the learning management system (Blackboard)? Why/Why not?
- 6) Were the discussion threads easy to navigate through? Why/Why not?
- 7) Do you think students should be divided in groups for better interaction? Why/Why not?
- 8) Do you think all the course notes should be released early in the course or periodically? Why/Why not?
- 9) Do you think assignments should be released early in the course or periodically? Why/Why not?
- 10) Do you think it will be easier to follow assignment threads inside group discussion forums? Why/Why not?
- 11) Do you think the “Welcome and Introduction” thread was enough to create a community of students? Why/Why not?
- 12) Which forums within blackboard do/did you access most and why/Why not?
- 13) In which forum within blackboard do/did you post most and why/Why not?
- 14) Which media did you find most effective? Elluminate or Group discussion forum or General discussion forum? Why?
- 15) Do you think the assignment threads should be handled by the tutors? Why/Why not?

- 16) Do you think there should be E-books, available in Blackboard? Why/Why not?
- 17) Do you have any suggestions regarding how the course content and discussion threads should be managed?
- 18) Do you think there should be more information regarding which thread does what? If yes, what type of Information?

## **Appendix C: Plain Language Statement (Introduction to Information Technology)**



RMIT Human Research Ethics Committee

### **Plain language statement**

#### **INVITATION TO PARTICIPATE IN A RESEARCH PROJECT PROJECT INFORMATION STATEMENT**

**Project Title:** Analysis of Online Discussion Forums for Introductory Programming and IT Students.

**Investigators:**

- o Mr. Dip Nandi (PhD Student, CSIT, RMIT University, d.nandi@student.rmit.edu.au)
- o Dr Margaret Hamilton (Project Supervisor: Senior Lecturer, CSIT, RMIT UNIVERSITY, margaret.hamilton@rmit.edu.au, 9925-2939)
- o Dr. James Harland (Co-Supervisor, Associate Prof., CSIT, RMIT UNIVERSITY, james.harland@rmit.edu.au, 9925-2045)
- o Mr. Geoff Warburton (Investigator, Lecturer, CSIT, RMIT UNIVERSITY, geoffw@cs.rmit.edu.au, 9925-1049)

Dear Insutrctors and students

You are invited to participate in a research project being conducted by RMIT University. This information sheet describes the project in straightforward language, or 'plain English'. Please read this sheet carefully and be confident that you understand its contents before deciding whether to participate. If you have any questions about the project, please ask one of the investigators.

**Who is involved in this research project? Why is it being conducted?**

This research has been undertaken as part of the Degree "Doctor of Philosophy" conducted by Mr Dip Nandi under the supervision of Dr. Margaret Hamilton and Associate Prof. James Harland. This project has received clearance by the RMIT HREC (Human Research Ethic Committee).

**Why have you been approached?**

As instructors and students of the course Introduction to Information Technology - CPT110 which provides a complete online learning environment, we invite you to participate in our research project.

**What is the project about? What are the questions being addressed?**

The aim of our research is to find ways to better engage students in an online learning environment so that the required skills of problem solving, critical thinking etc can be achieved by the students through the online environment.

**If I agree to participate, what will I be required to do?**

Should you agree to participate, you would be asked to contribute in the following way:

- Participate on the discussion forum as you would during the normal course of this subject
- Participate in a survey which will take around 20-25 minutes around the middle or end of the semester.
- If you are an instructor, you will be interviewed for 20-25 minutes

You have the right to view the answers to the survey questionnaires and the logging data at any time during and after the semester. We estimate that the extra time required of you will not exceed 30 minutes if you participate to the survey.

**What are the risks or disadvantages associated with participation?**

Participation to this study will not have any impact on your academic results for the subjects you are undertaking. The only anticipated inconvenience is the time participating in the survey. The students will participate in the survey anonymously. Please be advised that respective instructors will not have access to the survey data directly and will not be able to identify their students.

As required by the University, data will be held in locked cabinets in the School of Computer Science and Information Technology and destroyed using confidential waste disposal techniques after five years following the last publication from the research. You will participate in the survey anonymously and so you will not be identifiable in the research report written up for this research project.

**What are the benefits associated with participation?**

The benefits of the proposed research are towards facilitators, as a way to assess learners' online contributions, while students can use it to understand what is expected of them as participants in

online discussion forums. This will guide educators to better design online systems and encourage collaborative learning which will ultimately benefit student learning.

***What will happen to the information I provide?***

The information you provide will be treated as confidential and used for research purposes connected with this research project only. Confidentiality of the information provided will be protected subject to any legal limitations. Access to the information will be restricted to the investigators only.

Once the study has been completed, a brief summary of the findings will be available on request by contacting Dr Hamilton, Dr. Harland or Mr Nandi personally.

***What are my rights as a participant?***

Please be advised that your participation in this study is completely voluntary. Should you wish to withdraw at any stage, or to withdraw any unprocessed data you have supplied, you are free to do so without prejudice.

***Whom should I contact if I have any questions?***

If you have any questions about this research project please contact any of the investigators. Should you have any concerns about the conduct of the project, you are welcome to contact the Executive Officer, HREC, RMIT University, on ph: (03) 9925 6597 or 9925 2251.

***What other issues should I be aware of before deciding whether to participate?***

None

Yours sincerely

Mr. Dip Nandi  
PhD Student, CSIT, RMIT University

Dr Margaret Hamilton  
Senior Lecturer, CSIT, RMIT UNIVERSITY

Dr. James Harland  
Associate Prof., CSIT, RMIT UNIVERSITY

Mr. Geoff Warburton  
Lecturer, CSIT, RMIT UNIVERSITY

Any complaints about your participation in this project may be directed to the Executive Officer,  
RMIT Human Research Ethics Committee, Research & Innovation, RMIT, GPO Box 2476V,  
Melbourne, 3001.

Details of the complaints procedure are available at:  
[http://www.rmit.edu.au/research/hrec\\_complaints](http://www.rmit.edu.au/research/hrec_complaints)

***Security of the website***

Users should be aware that the World Wide Web is an insecure public network that gives rise to the potential risk that a user's transactions are being viewed, intercepted or modified by third parties or that data which the user downloads may contain computer viruses or other defects.

***Security of the data***

This project will not use any external site to create, collect and analyse data collected in a survey format. The site we are using is RMIT Website. If you agree to participate in this survey, the responses you provide to the survey will be stored on a host server that is used by RMIT University. No personal information will be collected in the survey so none will be stored as data. Once we have completed our data collection and analysis, data in RMIT server will be stored securely for a period of five (5) years. The data on the RMIT University host server will then be deleted and expunged.

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Further information is available from the Ethics Executive Officer, RMIT Human Research Ethics Committee on 9925 2251.

## Appendix D: Plain Language Statement (Introduction to Programming)



RMIT Human Research Ethics Committee

### Plain language statement

#### INVITATION TO PARTICIPATE IN A RESEARCH PROJECT PROJECT INFORMATION STATEMENT

**Project Title:** Analysis of Online Discussion Forums for Introductory Programming and IT Students.

**Investigators:**

- o Mr. Dip Nandi (PhD Student, CSIT, RMIT University, d.nandi@student.rmit.edu.au)
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**Why have you been approached?**

As instructors and students of the course Introduction to Programming - CPT120 which provides a complete online learning environment, we invite you to participate in our research project.

**What is the project about? What are the questions being addressed?**

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Yours sincerely

Mr. Dip Nandi  
PhD Student, CSIT, RMIT University

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Senior Lecturer, CSIT, RMIT UNIVERSITY

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Mr. Geoff Warburton  
Lecturer, CSIT, RMIT UNIVERSITY

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